Using Healthcare Information For Better Decision-Making

Masters in Public Health

PMO 527

Raymond S. Crawford, III, MD, MBA

Clinical Knowledge Management

- Theory of Clinical Knowledge Management
- Types of information healthcare executives need
- Information sources and safeguards for accuracy
- Analytic approaches to information
- Making change

Clinical Knowledge Management
Six Million Dollar Man

- Age of technology
- Age of cost containment
- Age of accountability

Clinical Knowledge Management

“By the numbers ye shall be judged”

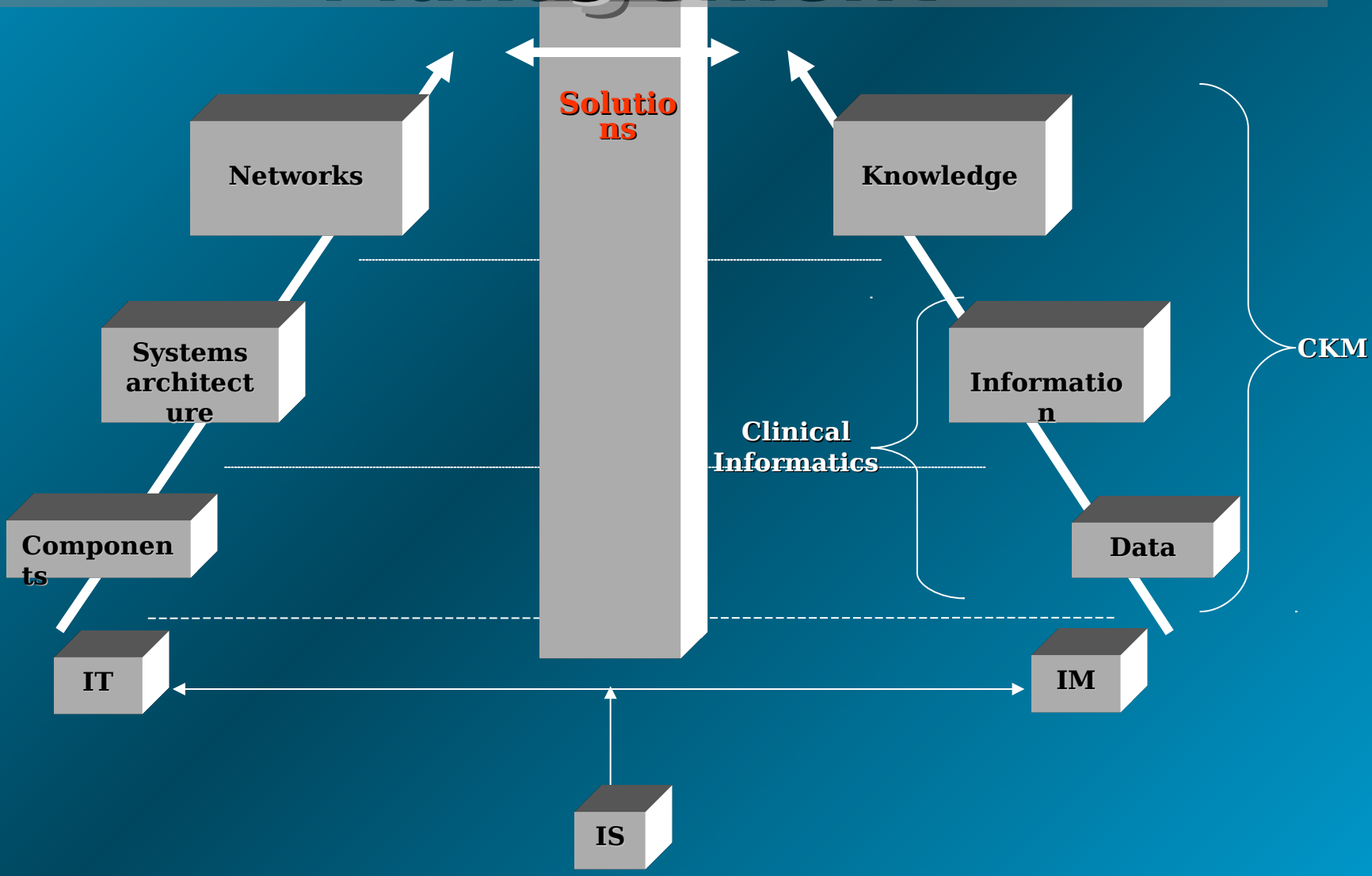
Clinical Knowledge Management

- **Theory of Clinical Knowledge Management**

Clinical Knowledge Management

- **What is it?**
  - **Information care givers need in order to reduce cost and improve quality**
  - **Use of this information to catalyze change**
    - **CPR – Clinical Process Re-engineering**

Clinical Knowledge Management



Clinical Knowledge Management

- Medical Informatics vs. CKM
- Episoding logic
- Strategic Information System development
- Information management hierarchy

Clinical Knowledge Management

Data Collection + Data Analysis = Performance Measurement

Clinical Knowledge Management

Performance Measurement + Change =

Performance Improvement

Clinical Knowledge Management

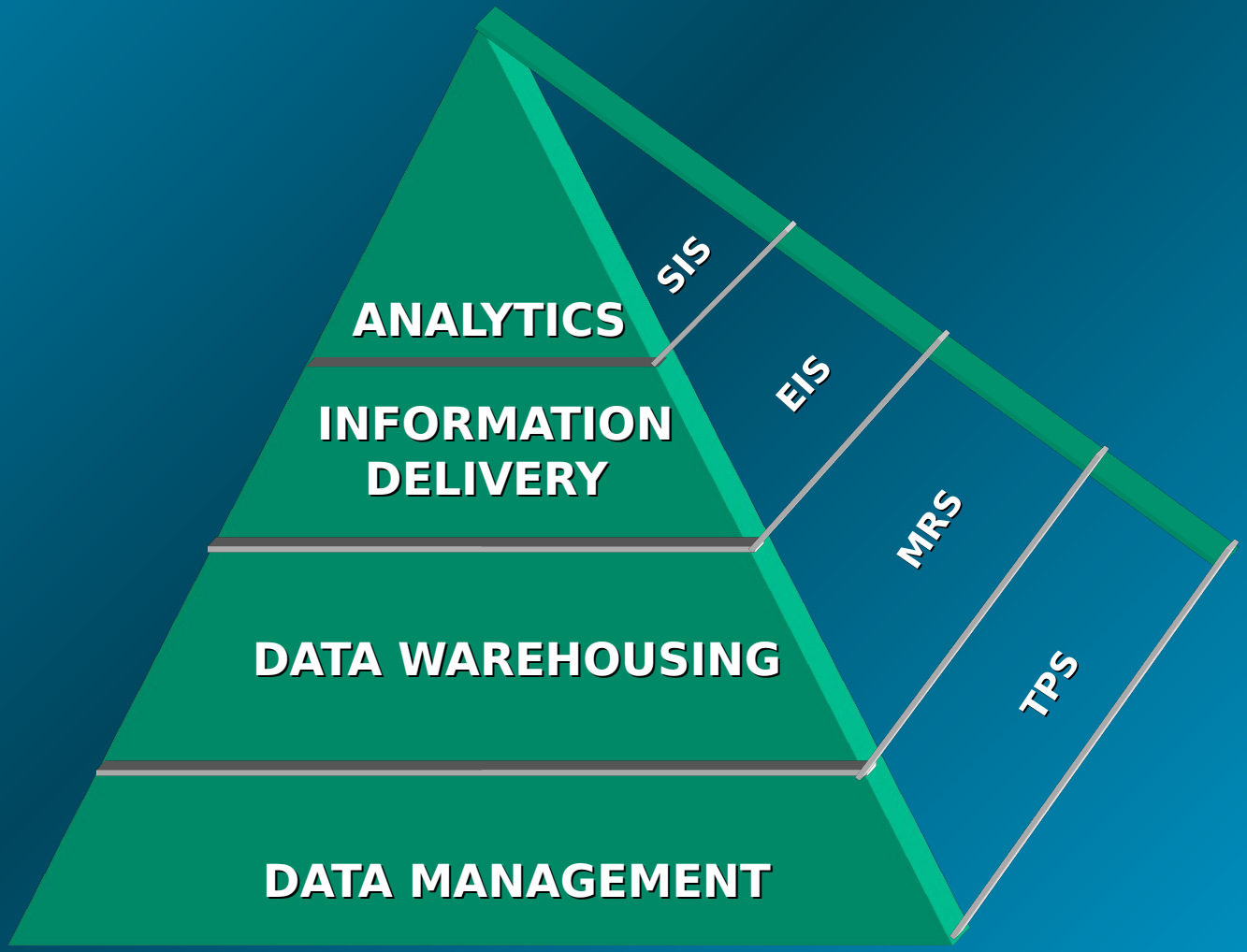
Data collection + data analysis = performance measurement (medical informatics)

Medical informatics + change (CPR) = performance improvement (CKM)

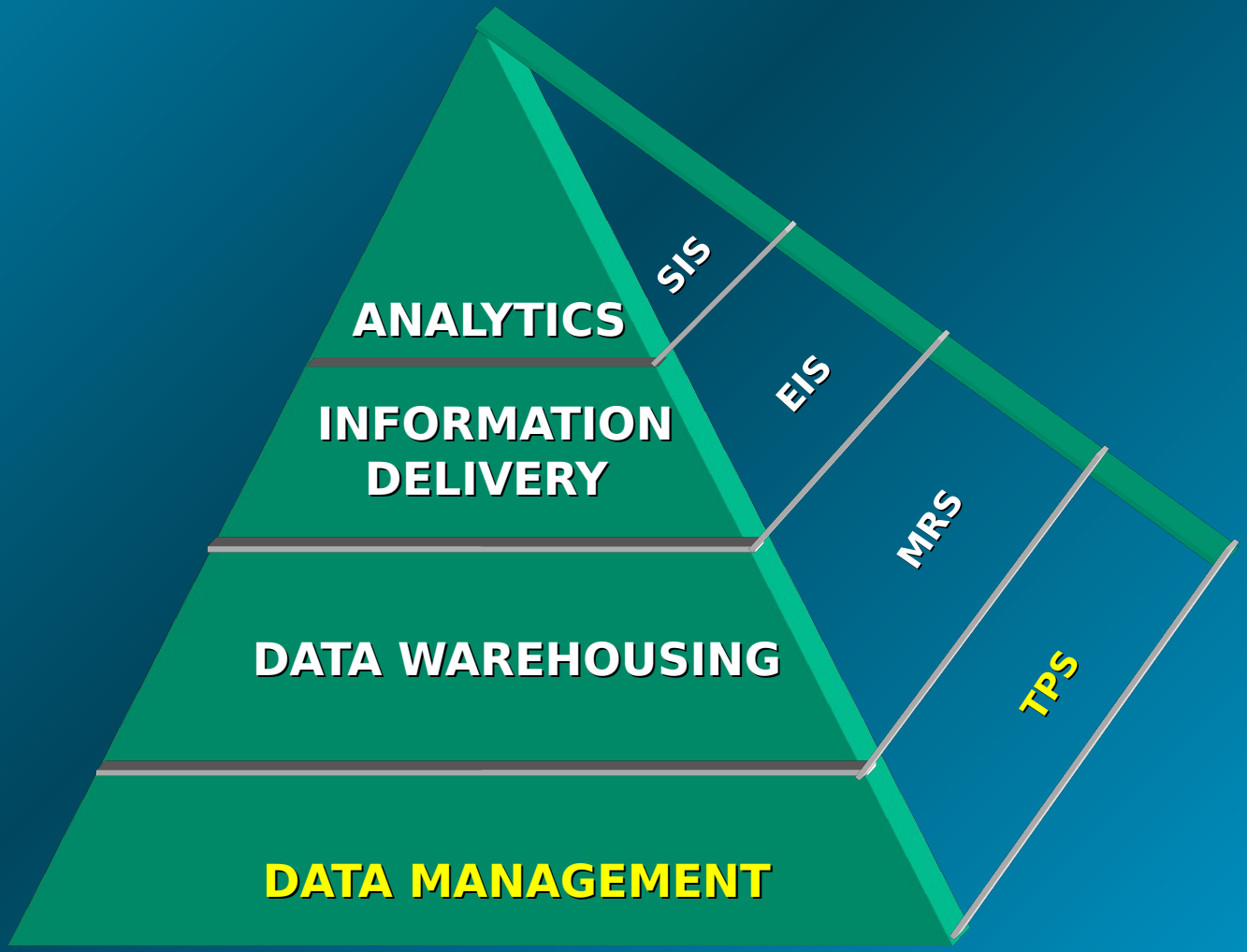
Clinical Knowledge Management
Episoding Logic

- Episode of service
- Episode of care
- Episode of illness
- Episode of disease
- Episode of risk

Clinical Knowledge Management
Strategic Information System Development



Clinical Knowledge Management
Strategic Information System Development



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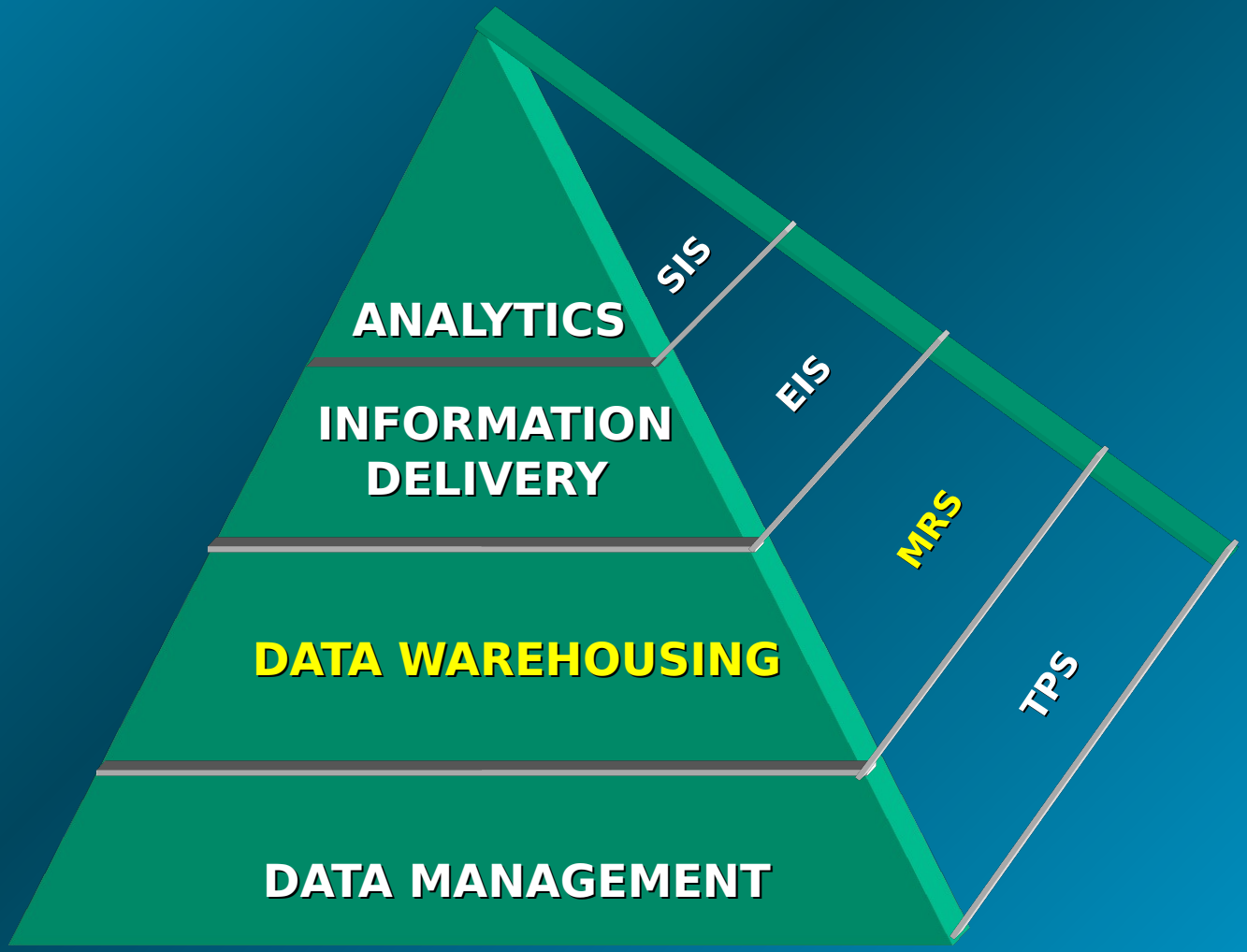
Strategic Information System Development



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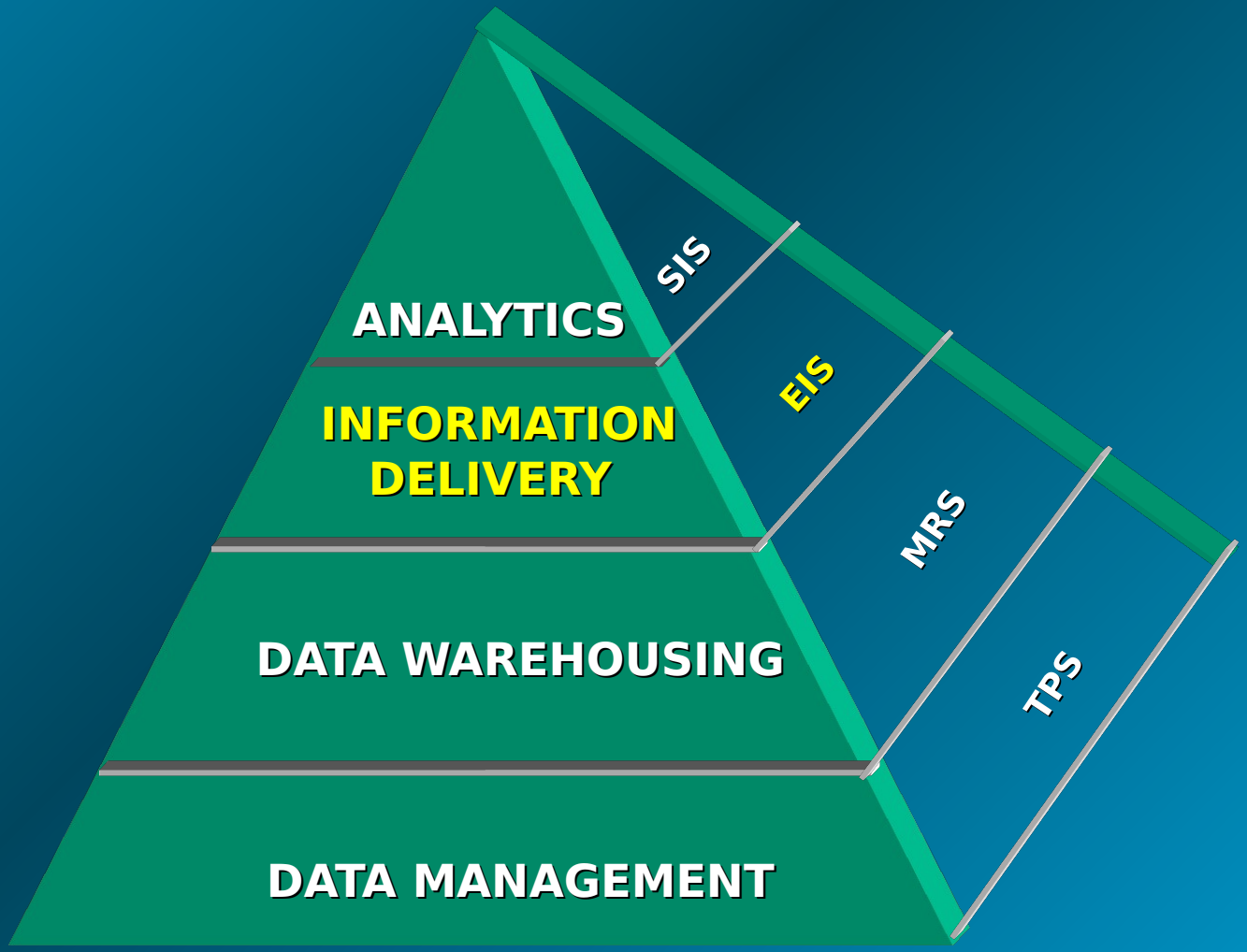
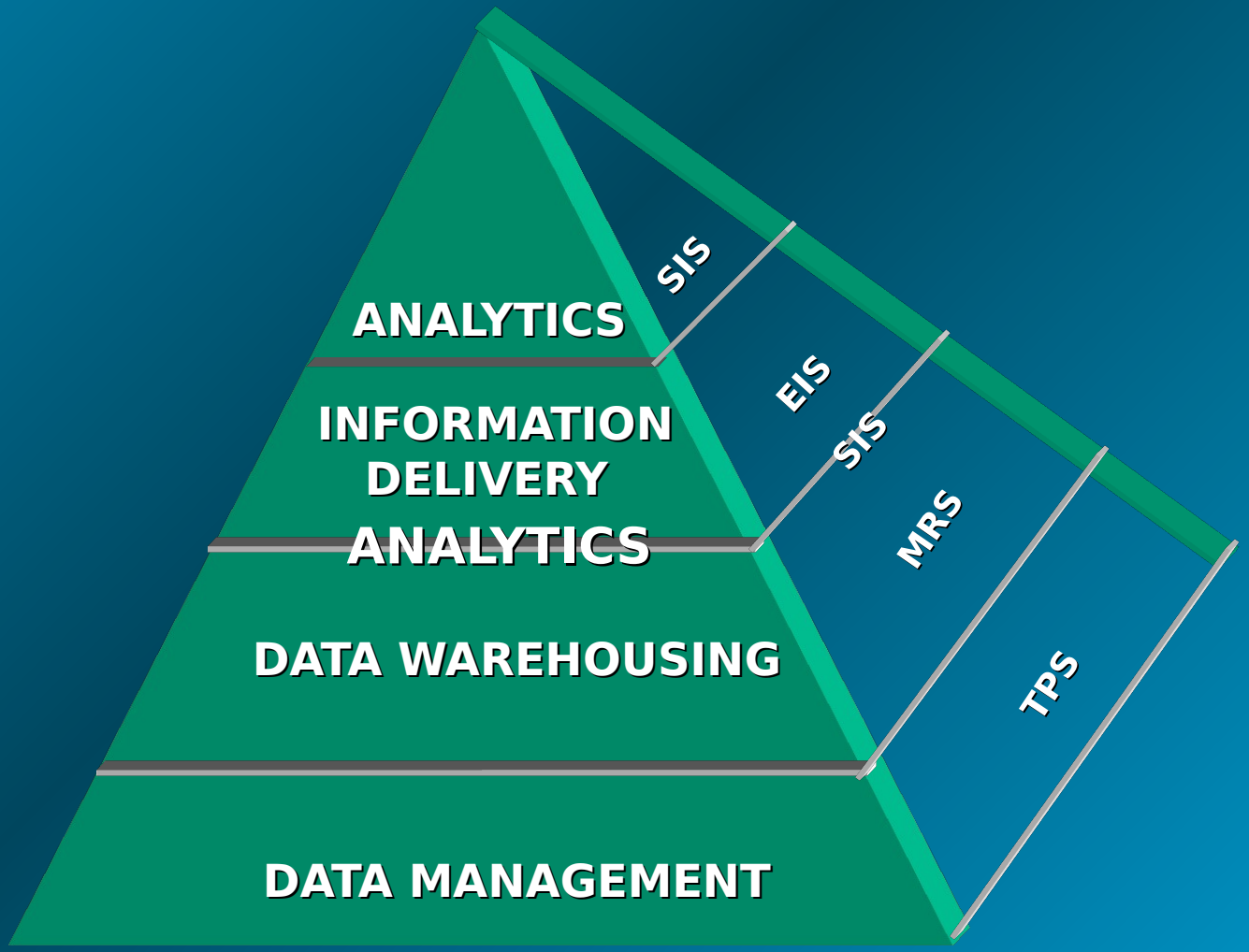
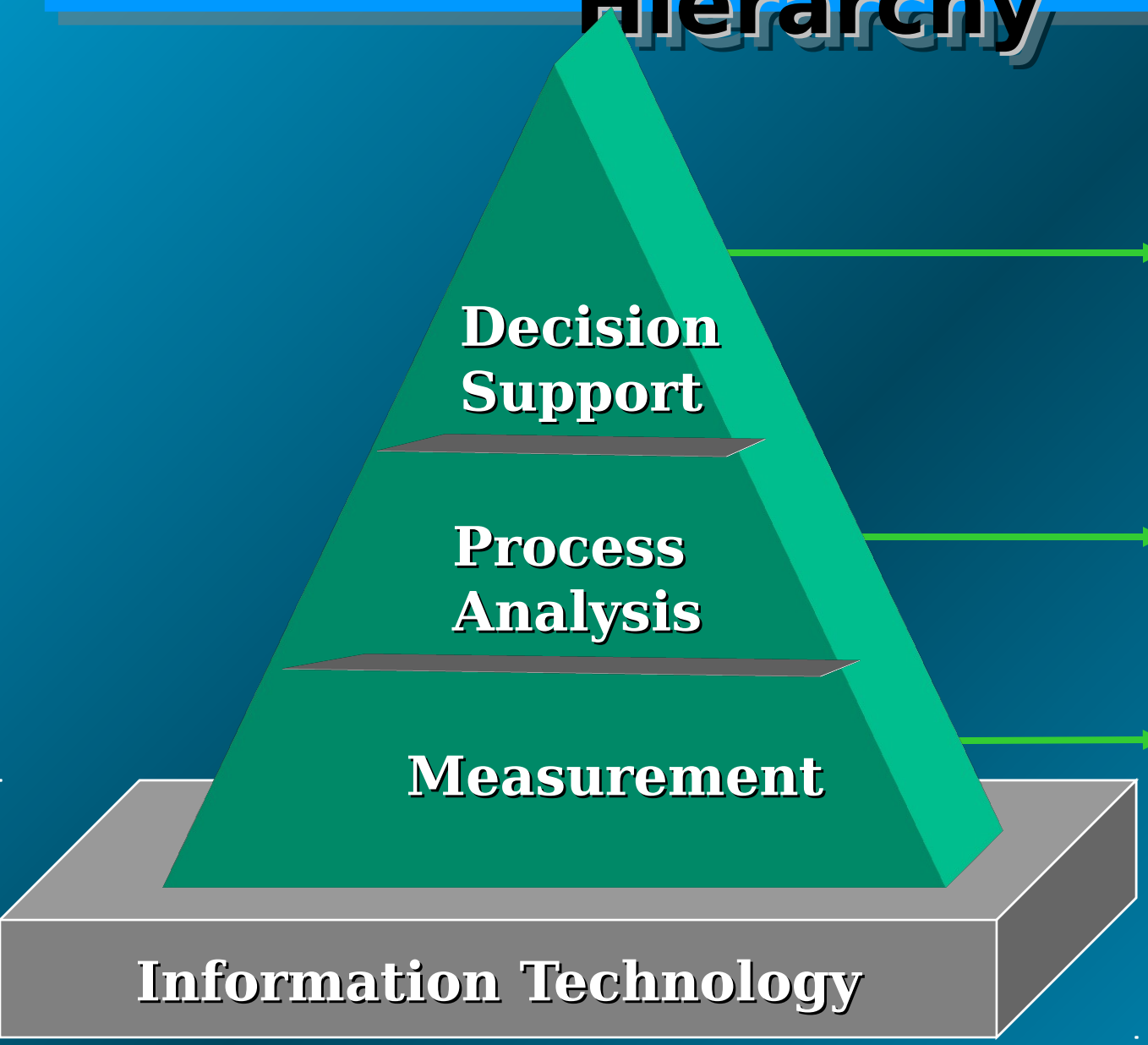


Clinical Knowledge Management
Strategic Information System Development



Information Management Hierarchy



Knowledge
Patient Specific
Actionable
"What if"

Process Information
Pathways
Guidelines
Best practices

Static Data
Report Cards
Profiles

Clinical Knowledge Management

- Theory of Clinical Knowledge Management

- Types of information healthcare executives need
  - Depends on your goals
    - Quality
    - Cost
    - Population level
    - Patient level

Clinical Knowledge Management
Types of Data

- **Population level**
  - Clinical data
  - Cost/resource use data
  - Satisfaction data
  - Health status data
- **Patient level**
  - Patient specific
  - Real-time
  - Interactive/dynamic

Clinical Knowledge Management

- Theory of Clinical Knowledge Management
- Types of information healthcare executives need
- Information sources and safeguards for accuracy

Clinical Knowledge Management
Data Sources

- Clinical data
  - Medical record
    - Paper
    - Electronic
      - Ancillary activities
- Cost/resource use data
  - Electronic
- Satisfaction data
  - Surveys
- Health Status data
  - Surveys

Clinical Knowledge Management
Data Accuracy & Confidentiality

- **Accuracy**
  - **Elements**
    - **Medical record documentation**
    - **Medical record coding**
    - **Medical record abstracting**
    - **Electronic data input**
    - **Electronic data throughput**

Legend:
m =m:\pw\tricare\
md = (m) data\
mp =(m)pharmacy\
si =(m)sidr\
sa =(m)sadr\

TRICARE EUROPE HEALTHCARE DATA EVALUATION
FY2000: October 1999 to September 2000

Standard Inpatient Data Record (SIDR) 1/4/2001

(si)\sidrEOM\sidr1099.txt (si)\sidrFiles\sidr10D99.txt
(si)\sidrEOM\sidr1199.txt (si)\sidrFiles\sidr11D99.txt
(si)\sidrEOM\sidr1299.txt (si)\sidrFiles\sidr12D99.txt
(si)\sidrEOM\sidr0100.txt (si)\sidrFiles\sidr01D00.txt
(si)\sidrEOM\sidr0200.txt (si)\sidrFiles\sidr02D00.txt
(si)\sidrEOM\sidr0300.txt (si)\sidrFiles\sidr03D00.txt
(si)\sidrEOM\sidr0400.txt (si)\sidrFiles\sidr04D00.txt
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(si)\sidrEOM\sidr0600.txt (si)\sidrFiles\sidr06D00.txt
(si)\sidrEOM\sidr0700.txt (si)\sidrFiles\sidr07D00.txt
(si)\sidrEOM\sidr0800.txt (si)\sidrFiles\sidr08D00.txt
(si)\sidrEOM\sidr0900.txt (si)\sidrFiles\sidr09D00.txt

Outpatient Prescription Data (Pharmacy) 1/4/2001

(mp)Tricare EUR Rx Q1 fy00.txt
(mp)Tricare EUR Rx Q2 fy00.txt
(mp)Tricare EUR Rx Q3 fy00.txt
(mp)Tricare EUR Rx Q4 fy00.txt

Standard Ambulatory Data Record (SADR1) 1/8/2001

(sa) sadr2000_1.txt	**(139,280 obs)**
(sa) sadr2000_2.txt	**(156,220 obs)**
(sa) sadr2000_3.txt	**(165,883 obs)**
(sa) sadr2000_4.txt	(3,091 obs)
(sa) sadr2000_7.txt	(141,440 obs)
(sa) sadr2000_8.txt	(169,504 obs)

(SADR2) 1/11/2001

(sa) January.txt	**(153,382 obs)**
(sa) February.txt	**(153,382 obs)**
(sa) March.txt	**(153,382 obs)**
(sa) May.txt	(153,382 obs)
(sa) June.txt	(153,382 obs)
(sa) October.txt	(153,382 obs)
(sa) November.txt	(153,382 obs)
(sa) December.txt	(153,382 obs)

(m)req001\ **r001dp1.sas**
Creates SAS Files

(mp)saslib\ **FY00Q2.** Sas7bdat (326,558 obs)

FMP_ID = FMP + SponsorSSN: Household ID
RxDate (yyyymmdd)
DrugName
DrugClass
Quantity
Pharmacy
Provider
Prov_Id

(m)req002\ **r002dp1.sas**
Creates SAS Files

(sa)saslib\ **SADR1_1.** Sas7bdat (139,239 obs)
(sa)saslib\ **SADR1_2.** Sas7bdat (156,208 obs)
(sa)saslib\ **SADR1_3.** Sas7bdat (165,882 obs)

FMP_ID = FMP + SponsorSSN
ServDate (mm/dd/yyyy)
BEN_CAT +FMP +PATID
E_M_Code,
PROC1, PROC2 ,PROC3, PROC4
Prov_Id, Prov_Spe,
Age, Gender, DOB, Marital,
MEPRS,
PatZip, PCM,
Enr_DMIS, Enr_parent,
Tmt_clinic,
Tmt_DMIS, Tmt_parent,
Tmt_region

(m)req005\ **r005jc1.sas**
Creates SAS Files

(sa)saslib2\ **SADR2_1.** Sas7bdat (27,902 obs)
(sa)saslib2\ **SADR2_2.** Sas7bdat (29,032 obs)
(sa)saslib2\ **SADR2_3.** Sas7bdat (31,060 obs)

BEN_CAT +FMP +PATID
Diagnosis1, Diagnosis2,
PatZip, PatRegion,

Select high frequency ICD 9 codes
Aggregate double records of Diagnosis1 and Diagnosis2 into 1 record per PATID

(27,899 + 29,030 + 31,060 = 87,989 patients
--> 87,975 patients across 3

(m)req005\ **r005dp4.sas**
From each Household in **SADR (1),**
selects 1 PATID per SERVDATE
(10%multiple PATIDs per SERVDATE were excluded)
Then merges with Pharmacy **FY00Q2** by **FMP_ID**
matching **RxDATE** within 3 days of **SERVDATE**

2 = (m)sasli\ **PHARSADR.** Sas7bdat (35,959 obs)
FMPPATID: 21,948 patients

(m)req005\ **r005dp2.sas**
Merges by BEN_CAT + FMP + PATID
If in both files

1 (sa)saslib2\ **SADR123.** Sas7bdat (83,825 obs)
FMPPATID: 83,802 patients

(m)req006\ **r006jc2.sas**
For each of 17 primary Diagnoses, generates lots of % of patients with prescription By Provider

Plots

(m)req006\ **r006dp1.sas** and **r006jc3.sas**
For each of 17 primary Diagnoses
erates 3 sets of 6 tables listing % of patients

r each E_M_Code: \ **TableA1.xls... TableA6.xls**
r each Procedure : \ **TableB1.xls... TableB6.xls**
r each Drug name: \ **TableC1.xls... TableC6.xls**

(m)req005\ **r005jc5.sas**
For each primary ICD-9 group (Diagnosis1),
Generates frequencies of
Patients, Visits, Procedures...

(m)req005\ **PatFreqs.xls**

(m)req005\ **r005jc3.sas**
Generates Frequencies of ICD-9 groups vs PROC1-PROC4 and E_M_Code

ed on Diagnosis1: (m)req005\ **ICDCPT1.xls**
ICDCPTG1.
ed on Diagnosis2: (m)req005\ **ICDCPT2.xls**
ICDCPTG2.

Clinical Knowledge Management

- Theory of Clinical Knowledge Management
- Types of information healthcare executives need
  - Depends on your goals
- Information sources and safeguards for accuracy and confidentiality
  - HIPAA
- Analytic approaches to information

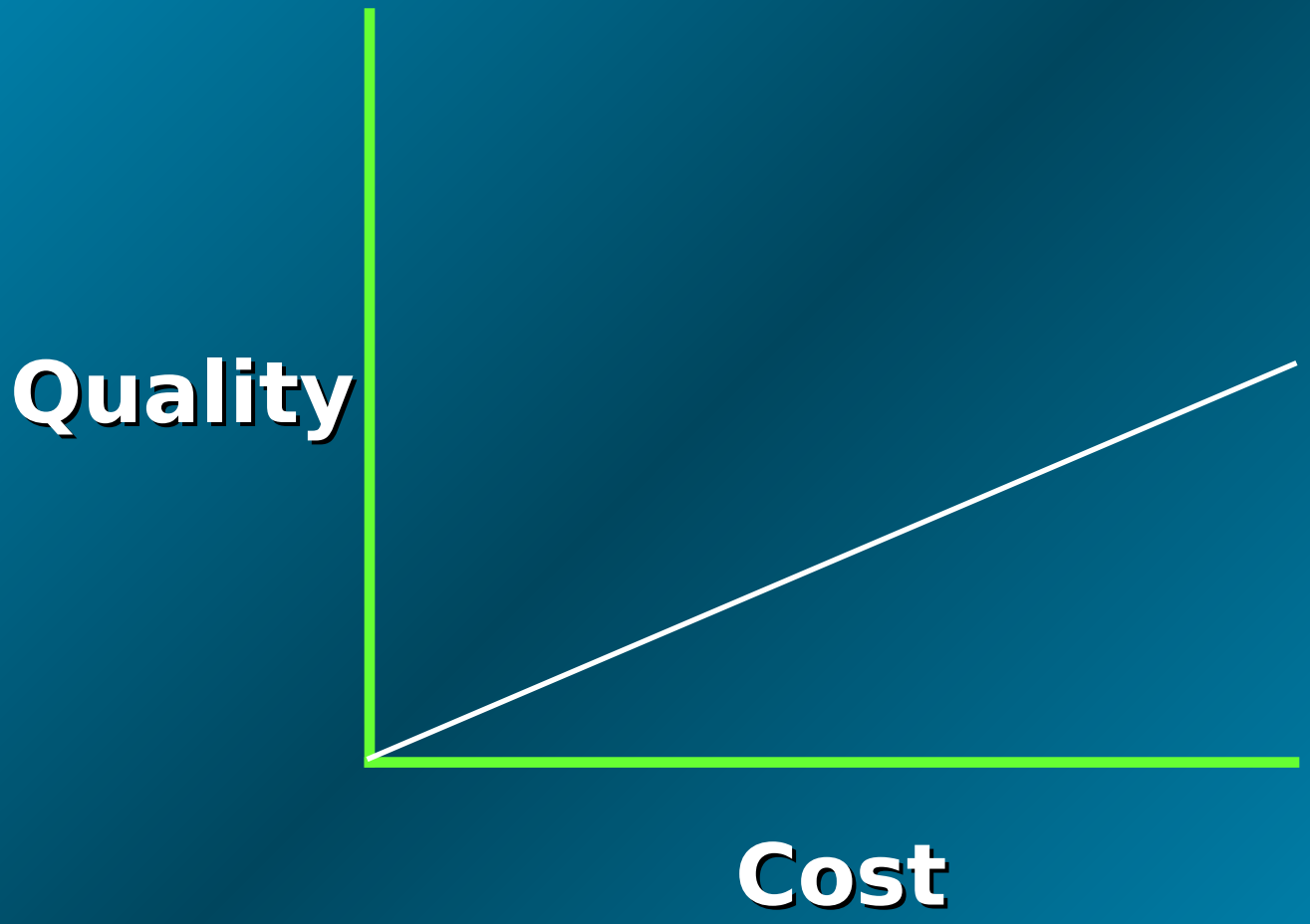
Clinical Knowledge Management Analysis

- What is the analysis goal?
  - Quality
  - Cost

- $\text{Value} = \frac{\text{Quality}}{\text{Cost}}$

Clinical Knowledge Management
Health Care Value

Clinical Knowledge Management
Healthcare Delivery Model

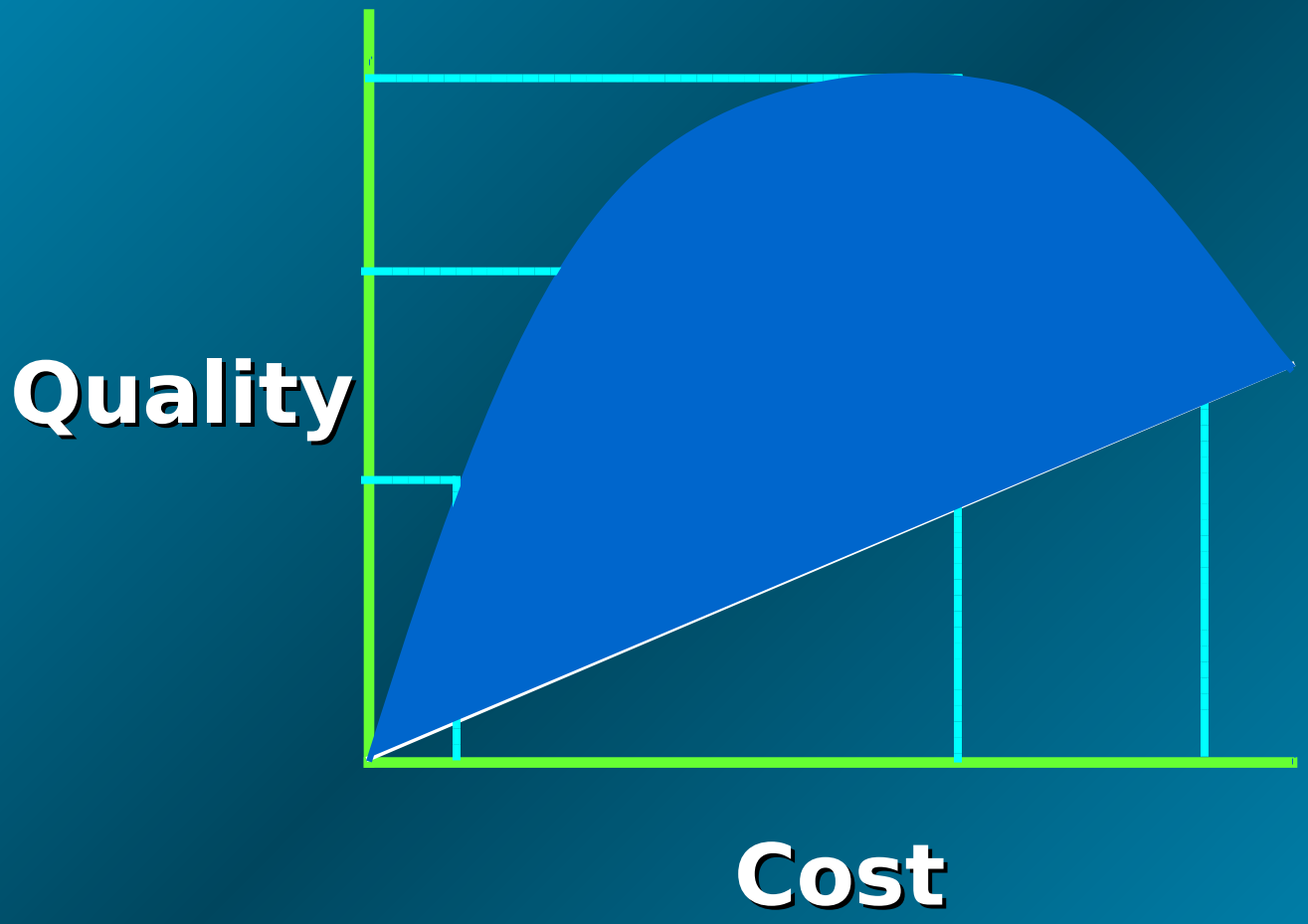


Clinical Knowledge Management

- **Variation in clinical practice <u>does</u> exist**
  - **Un-adjusted primary Cesarean section rates varied across the Commonwealth of Virginia from 8.44% to 21.24%**

<u>Obstetrical Services Guide</u>: A Consumer's Guide, Virginia Health Information, 1998

Clinical Knowledge Management
Healthcare Delivery Model



Clinical Knowledge Management

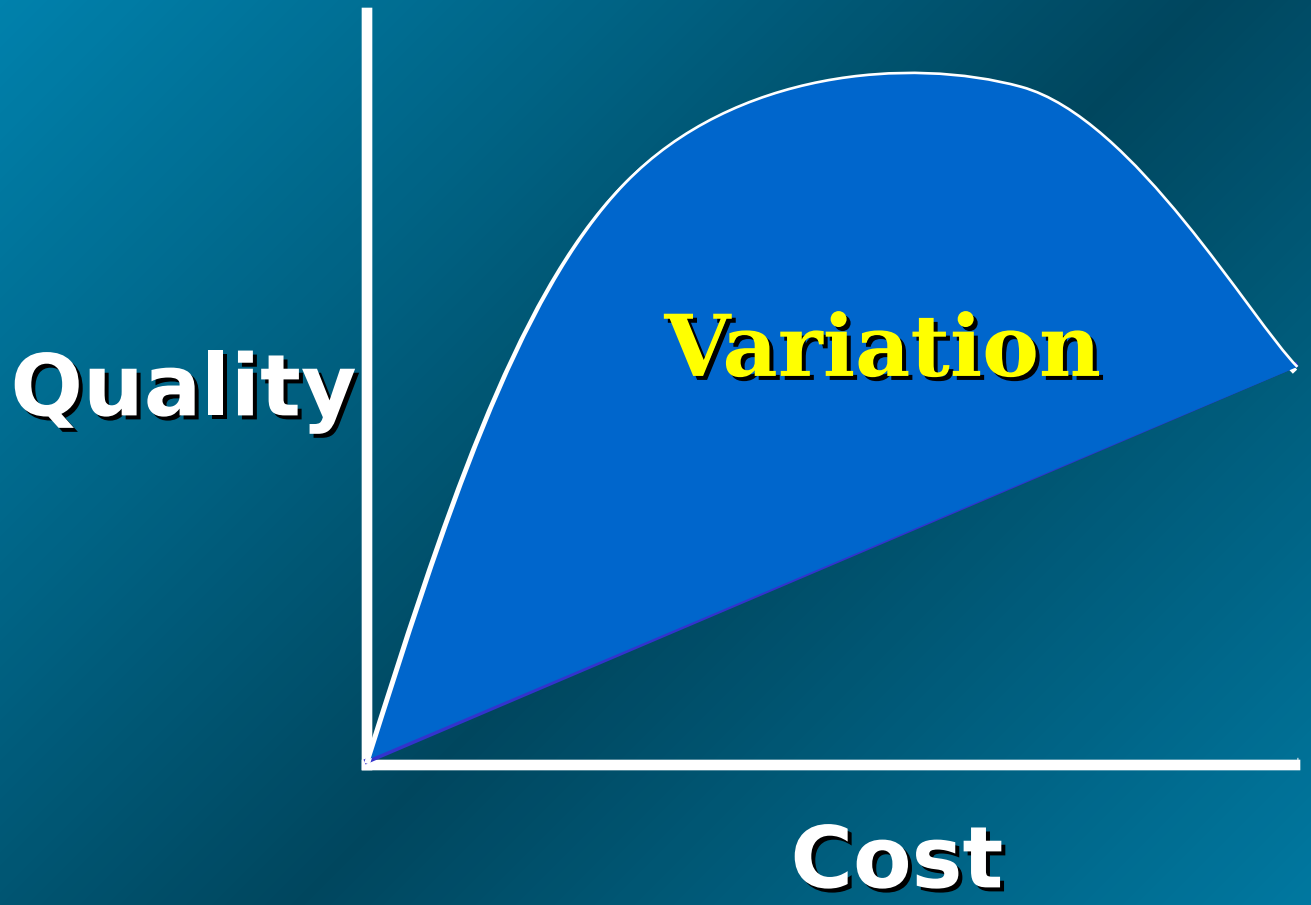
- **Variation in clinical practice does exist**
  - **Un-adjusted primary Cesarean section rates varied across the Commonwealth of Virginia from 8.44% to 21.24%**

Obstetrical Services Guide: A Consumer's Guide, Virginia Health Information, 1998

Clinical Knowledge Management Variation

Is Bad!

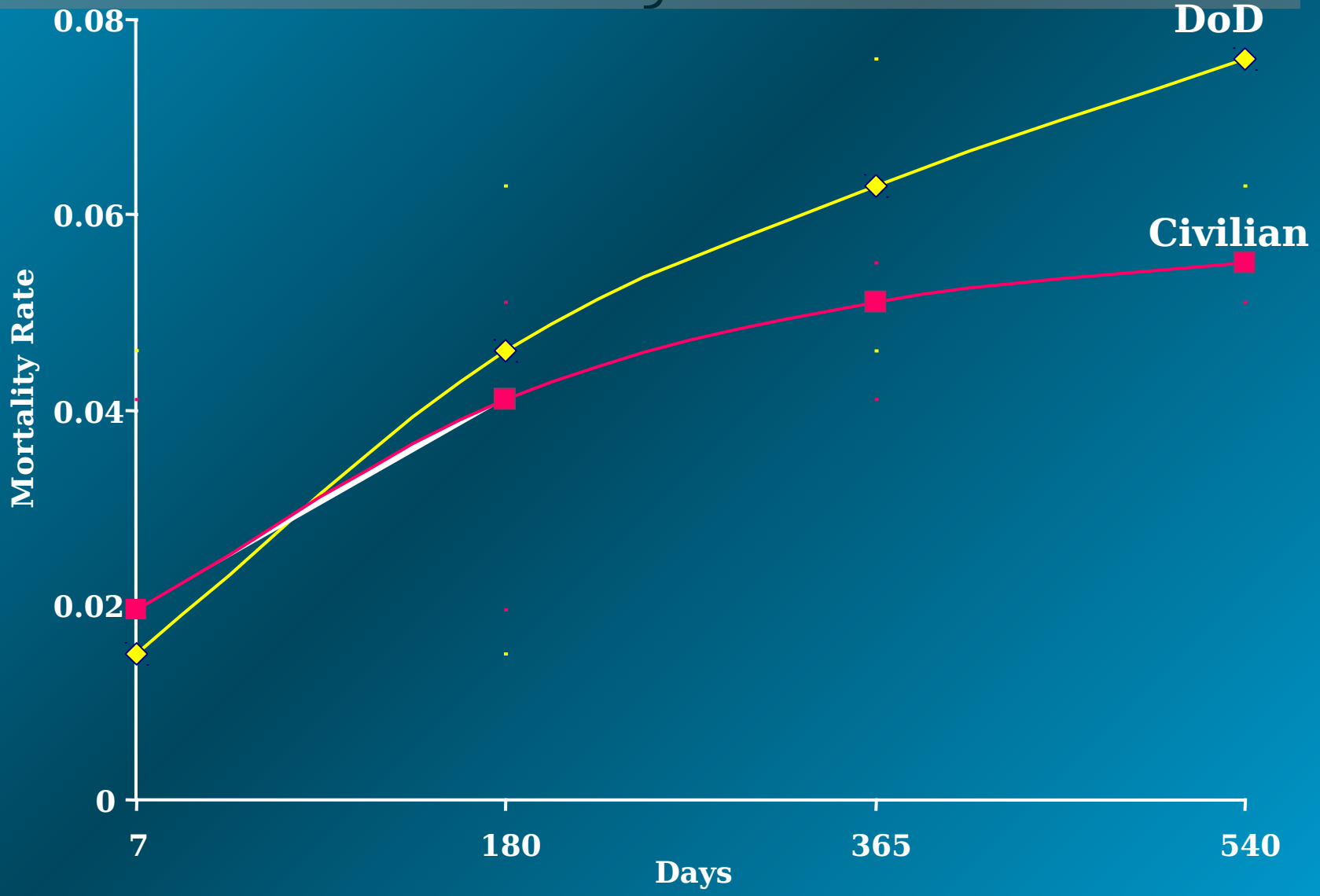
Value



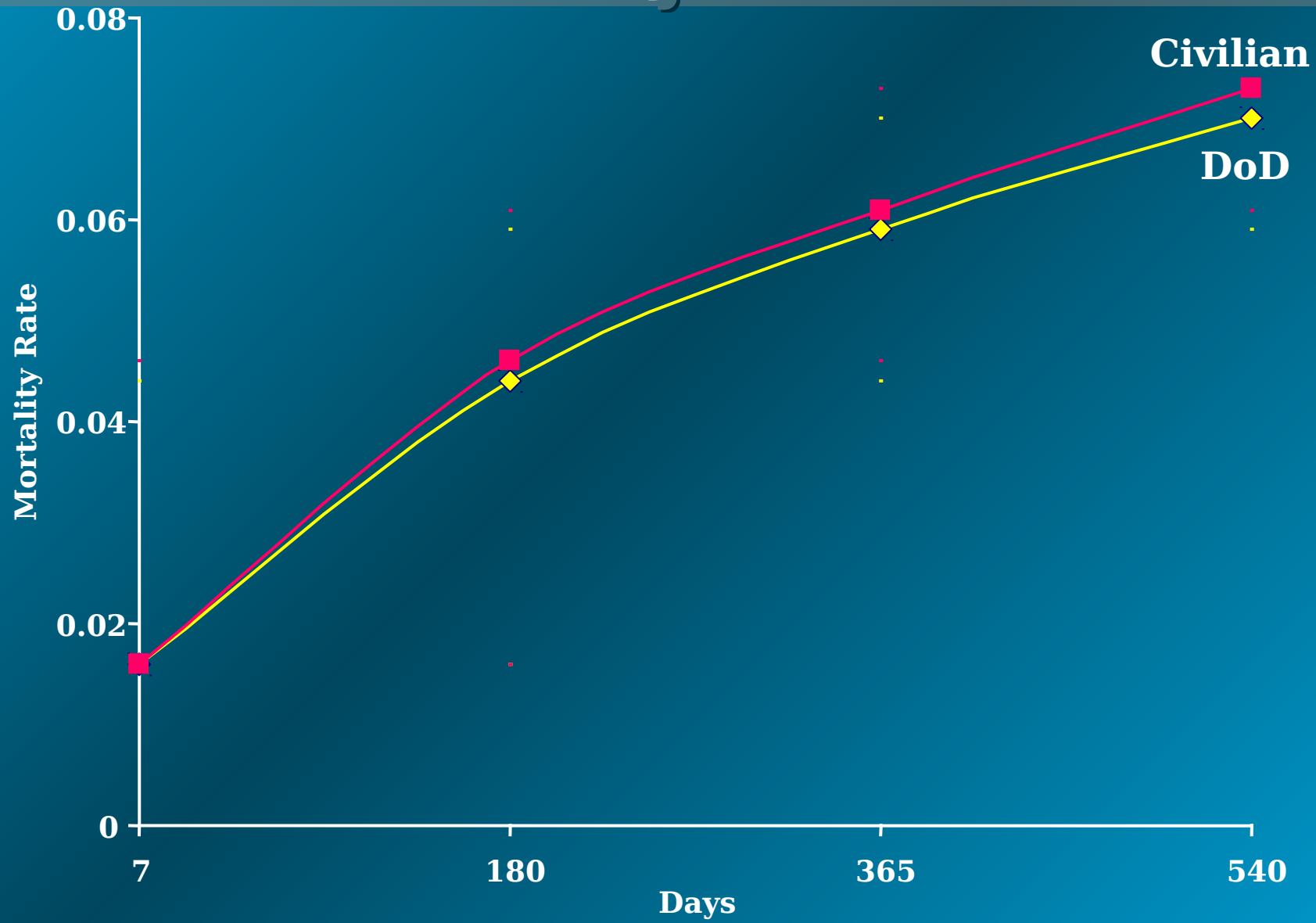
Clinical Knowledge Management

- **Variation can be caused by**
  - **Differences in patient severity**

Ischemic Heart Disease
No Risk Adjustment



Ischemic Heart Disease Risk Adjustment



Clinical Knowledge Management

- **Adjusting for patient severity of illness is critical**
  - **43% error rate in calculating the "right" hospital primary Cesarean rates**

    Risk Adjustment for interhospital comparison of primary Cesarean rates; Obstet Gynecol 1999 Jun;93(6):1025-30

  - **ACOG Press Release August 9, 2000 in response to CDC's most recently released National Vital Statistics Report – Birth Preliminary data for 1999**

    "…comparing Cesarean rates among medical institutions or physicians is not worthwhile unless it accounts for maternal risk factors."

Clinical Knowledge Management

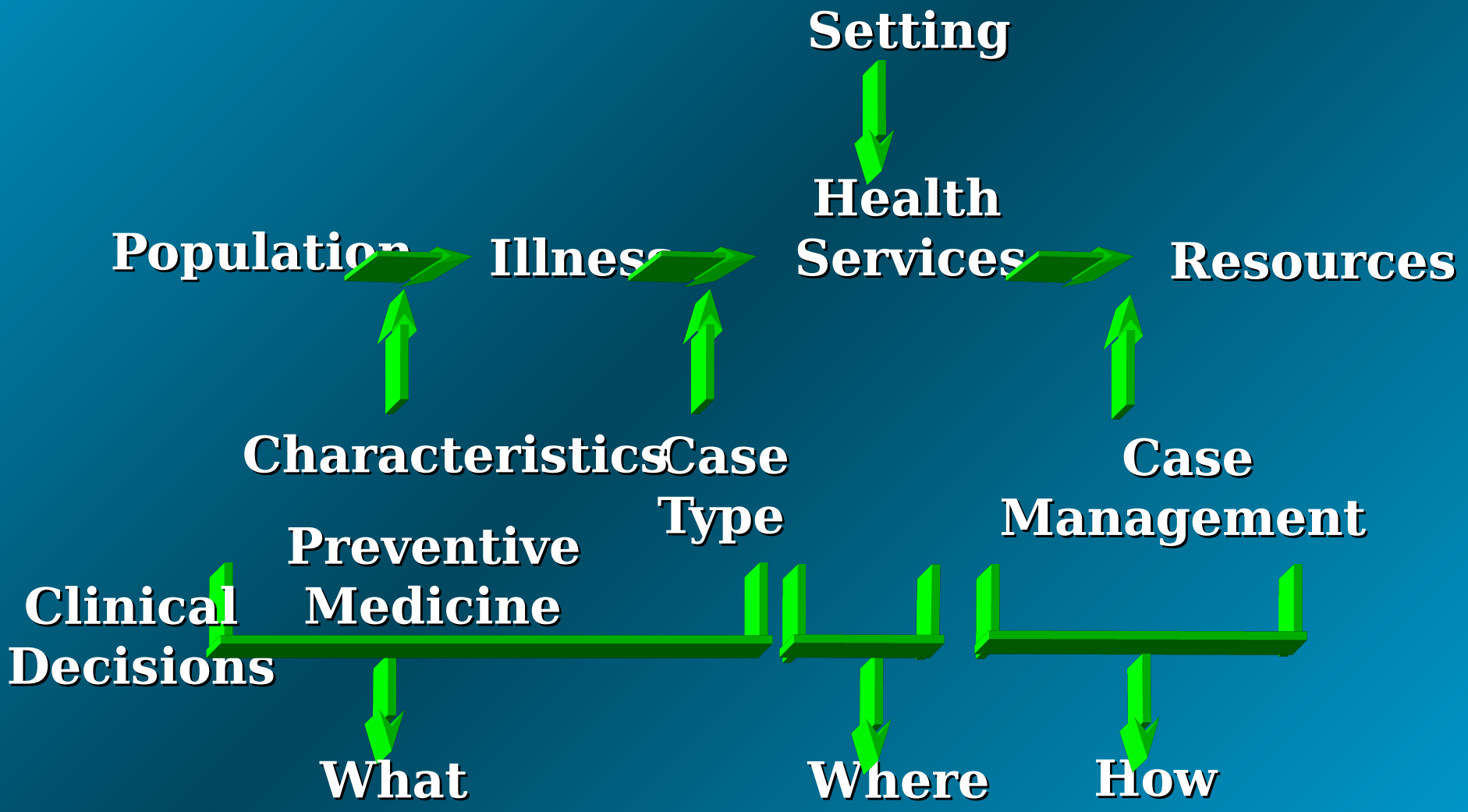
- **Variation can be caused by**
  - **Differences in patient severity**
  - **Differences in clinical decisions**
    - **Impact on outcomes and costs**
    - **Frequency**

Clinical Knowledge Management

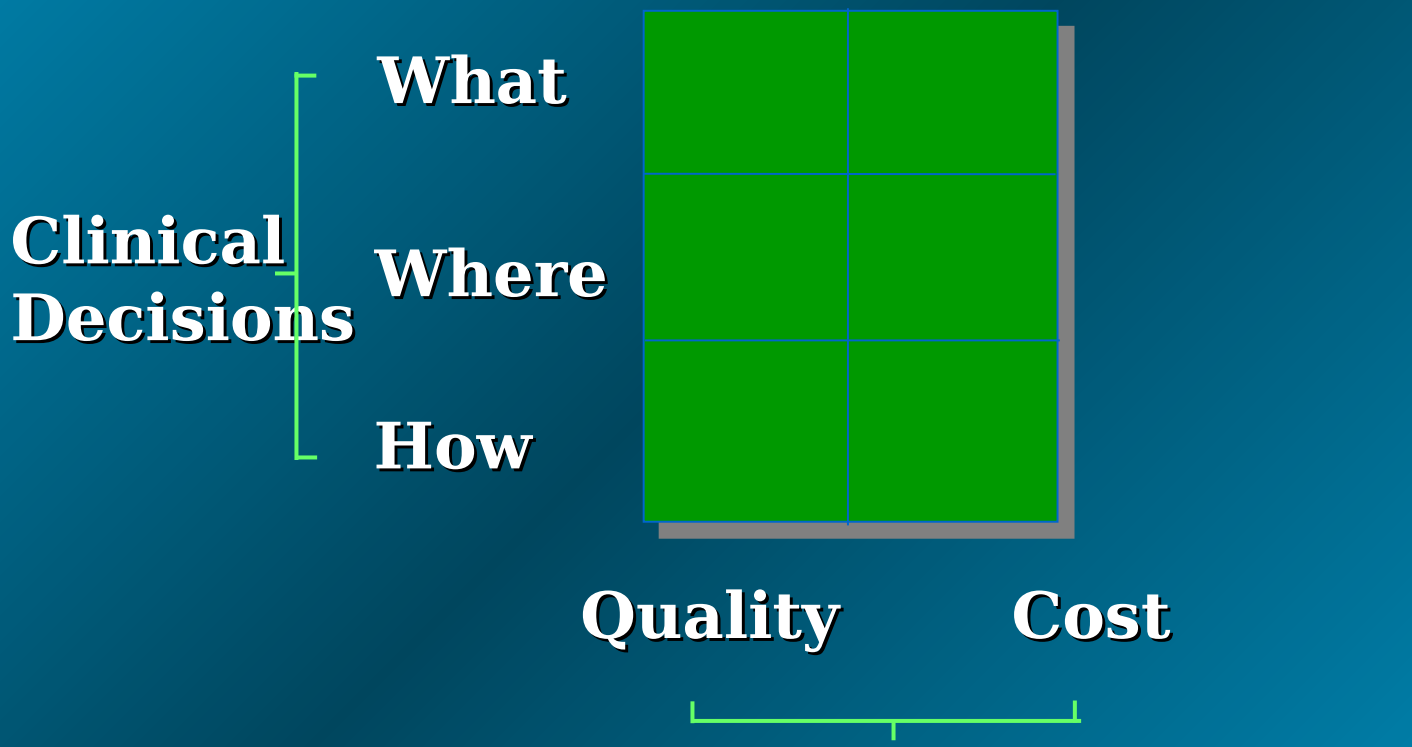
- **Adjust for patient severity**
- **Analyze clinical decisions**
  - **Impact on outcomes and costs**
  - **Frequency**
- **Identify combination of clinical decision that yield best practice**

Clinical Knowledge Management
Health Care Delivery Model

Clinical Knowledge Management
Health Care Delivery Model



Clinical Knowledge Management
Healthcare Delivery Model



Clinical Knowledge Management

Clinical Example

Health Care Information Line

Does it really work?

An Analysis of HCIL Calls Made in Alaska in Mar
with the orginal intent of going to the Emergenc

Raymond S. Crawford, III, MD,
Michael Cicciu

SAIC An Employee-Owned Company

McKESSON Empowering Healthcare

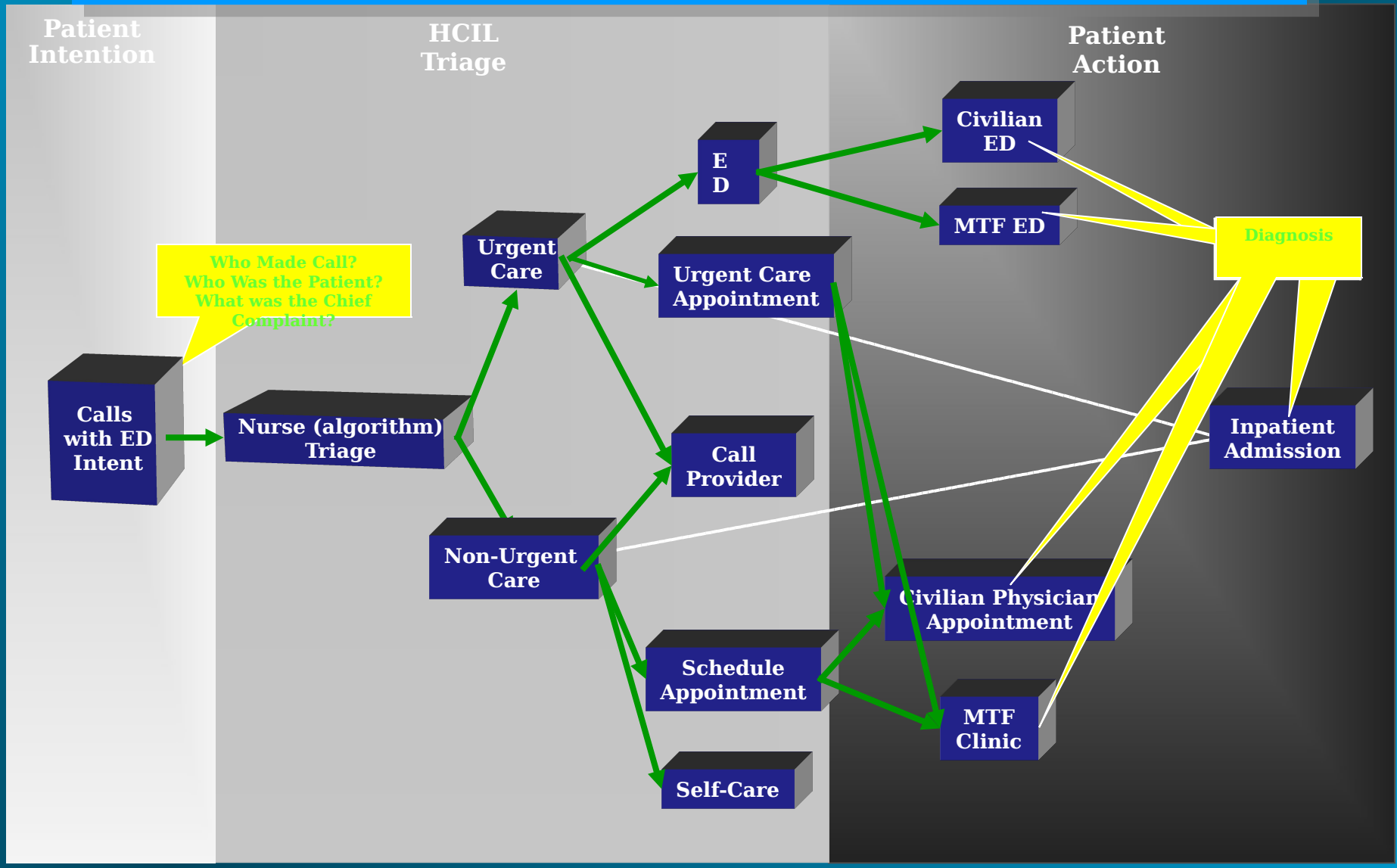
Reason For The Study

- **Emergency Department providers in Alaska questioned HCIL's value**
  - **They expressed concern that despite HCIL implementation, the number of patients seen in the EDs did not decrease.**

Study Protocol

- SAIC/McKesson studied the HCIL calls made in March 2002 with the original call intent to be an Emergency room visit
- Merged HCIL call data with SIDR, SADR, and HCSR data
- Followed patients through their interaction with the health system

Study Protocol



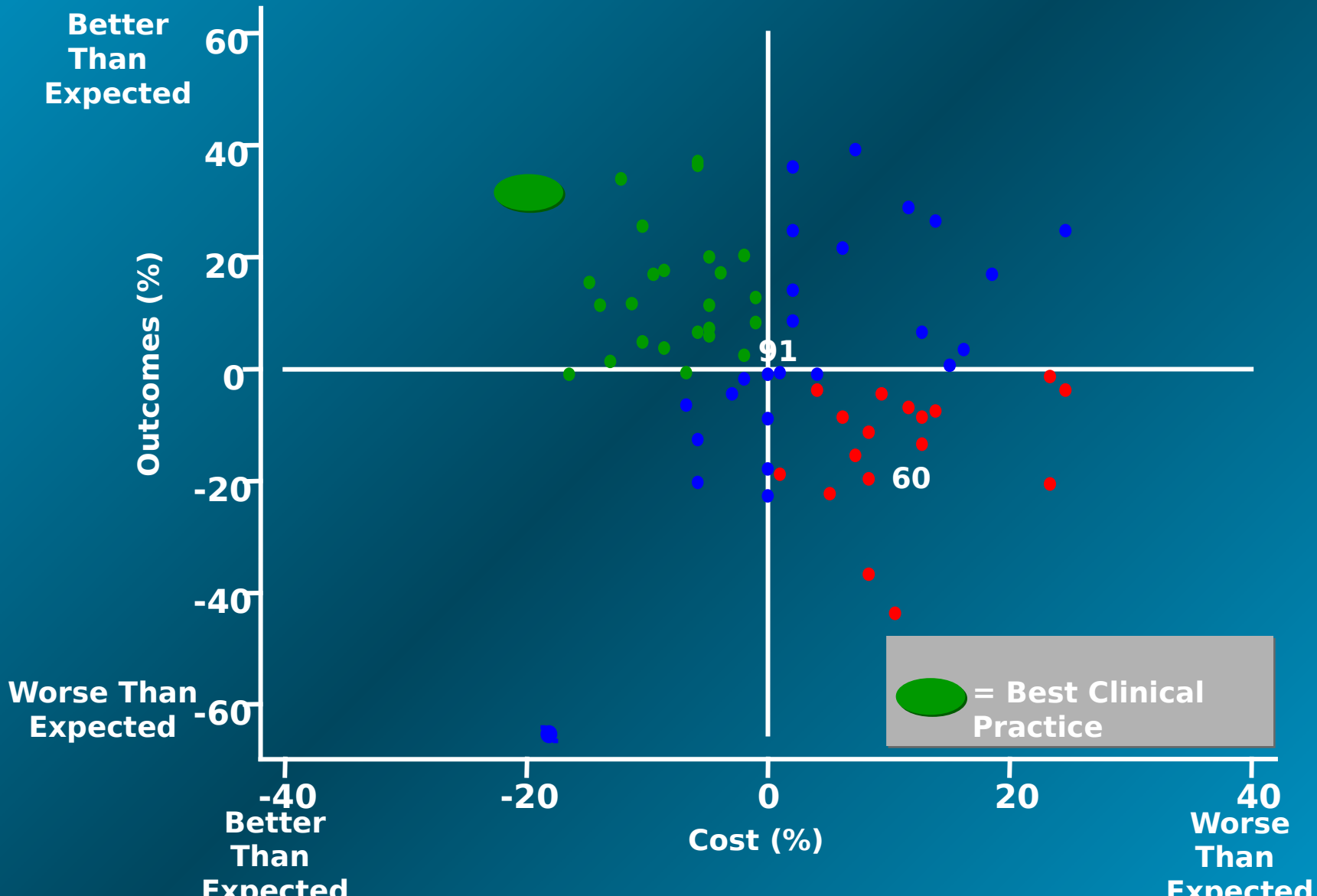
Findings

- 315 beneficiaries placed 333 calls
  - Average of 10.7 calls per day
  - 12 called twice
    - 9 <9 y/o
    - 1 10-19 y/o
    - 1 20-29 y/o
    - 1 31 y/o
  - 1 called three times
    - <9 y/o
  - 1 called five times
    - <1 y/o
- MTFs
  - Elmendorf AFB - 233
  - Ft. Wainright - 51
  - Eilson AFB - 35
  - Ft. Richardson - 14

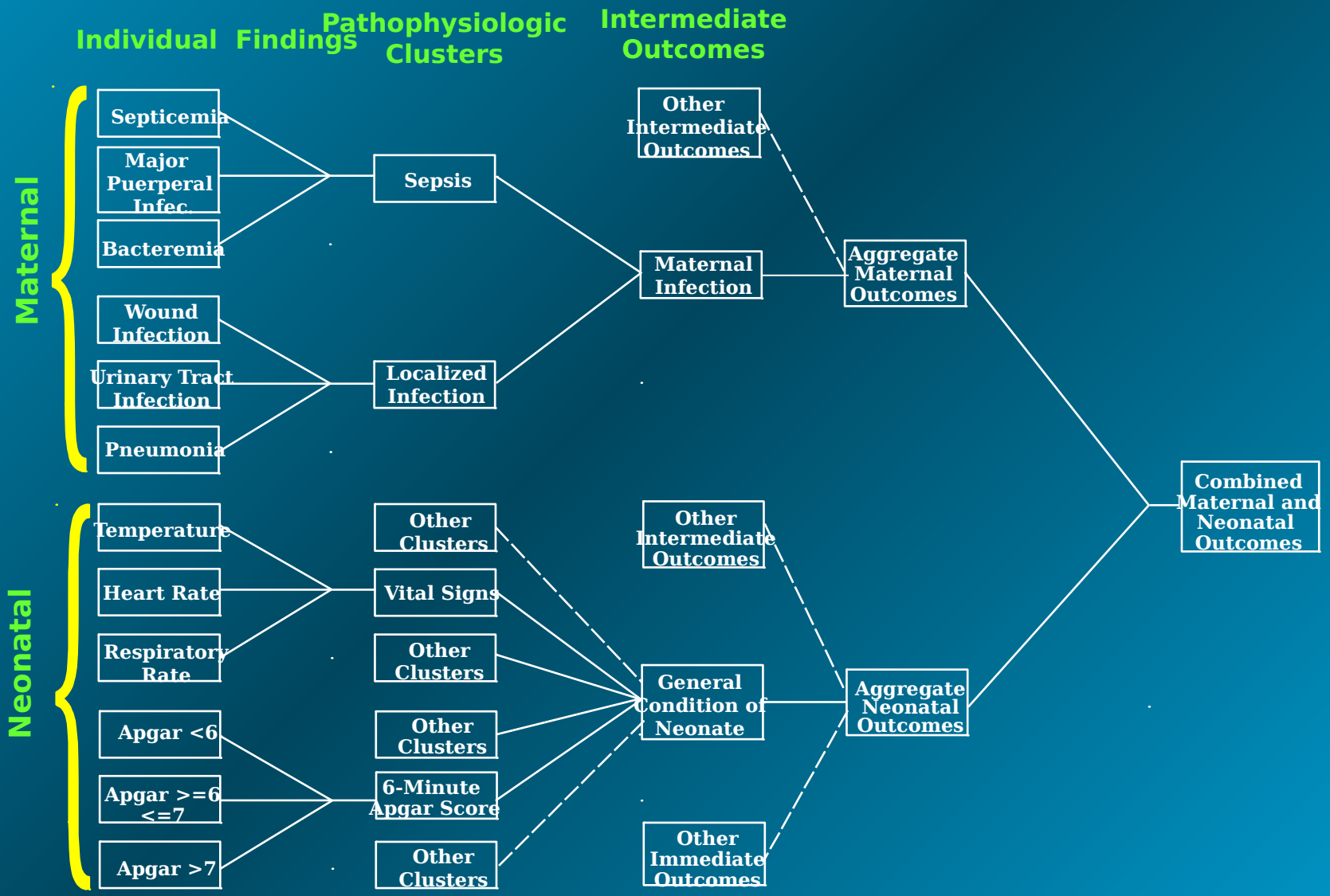
Findings

- The largest number of calls regarded beneficiaries age 1-9 years
- The second largest number of calls regarded beneficiaries ages 20-29 years
- Chief complaints
  1. Pediatric
     1. Diarrhea
     2. Upper respiratory
     3. vomiting
  2. Adult
  3. Abdominal Pain
  4. Vomiting
  5. Diarrhea
  6. Influenza

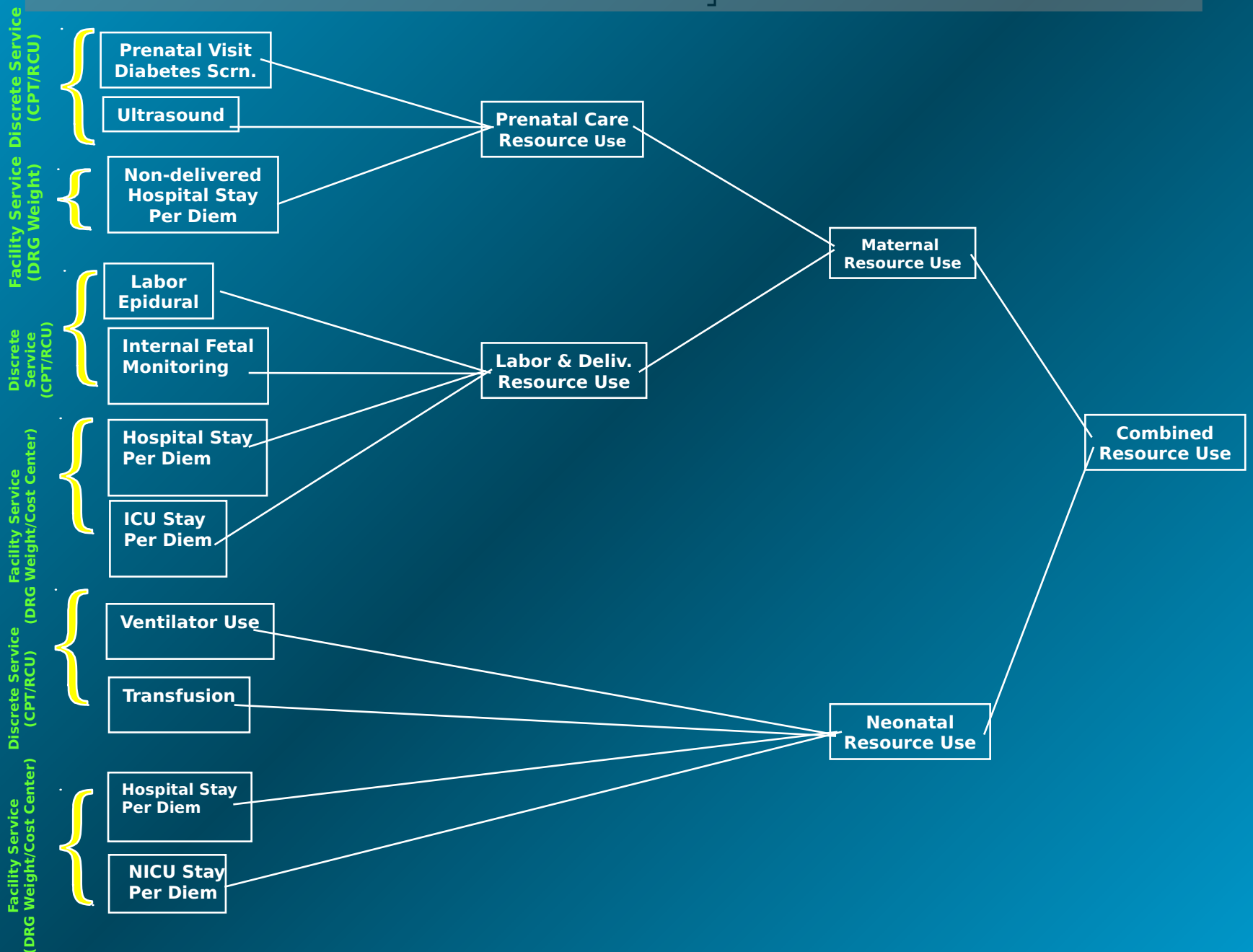
Pregnancy and Birth
Combined Maternal and Neonatal



Outcome Scoring Process
Combined

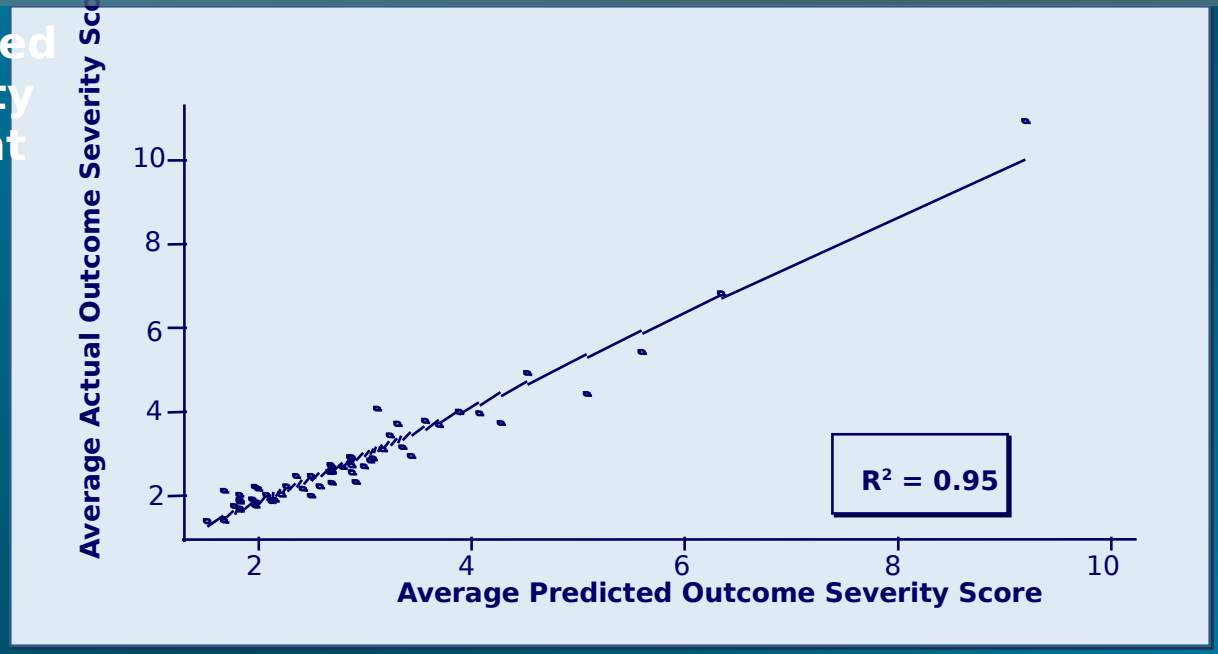


Resource Use Development Process

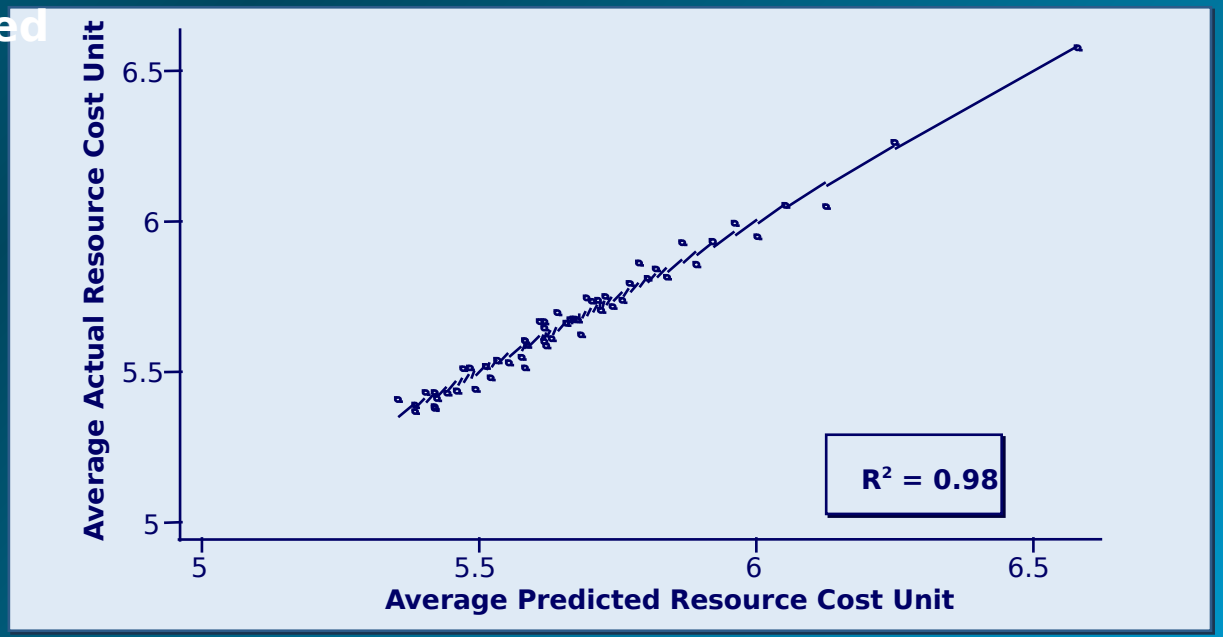


Birth Model Predictive Power

Actual to Expected Outcome Severity Scores by Patient Risk Cohorts (100 Cases)

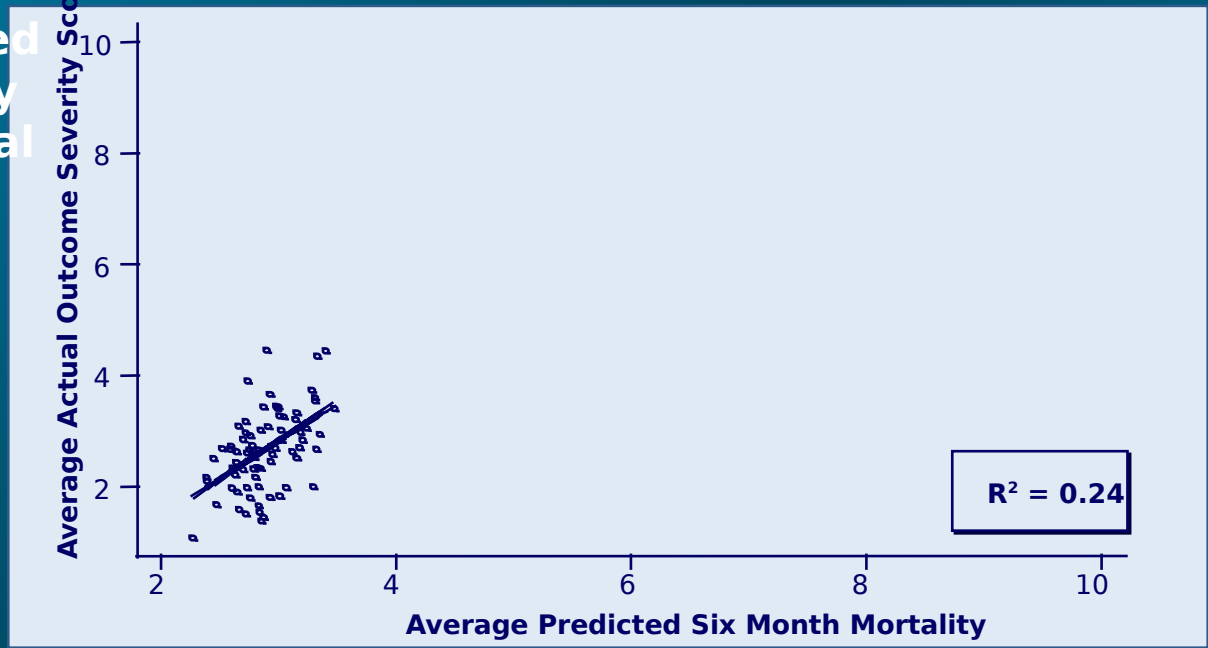


Actual to Expected Resource Consumption in RCUs by Patient Risk Cohorts (100 Cases)

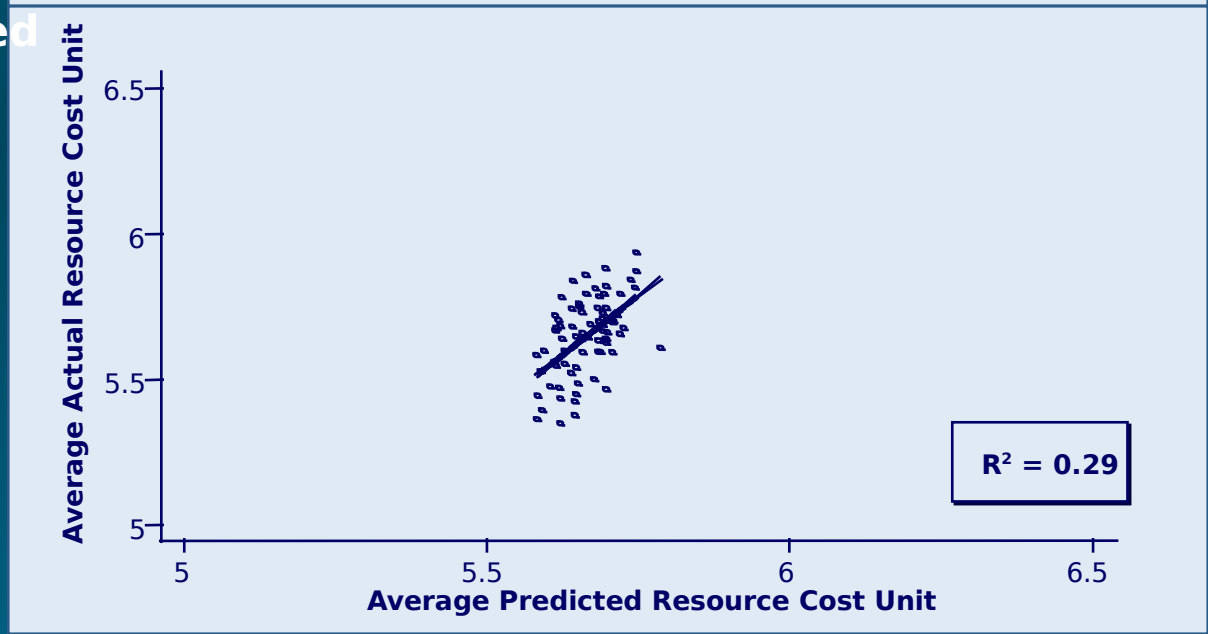


Birth Model Predictive Power

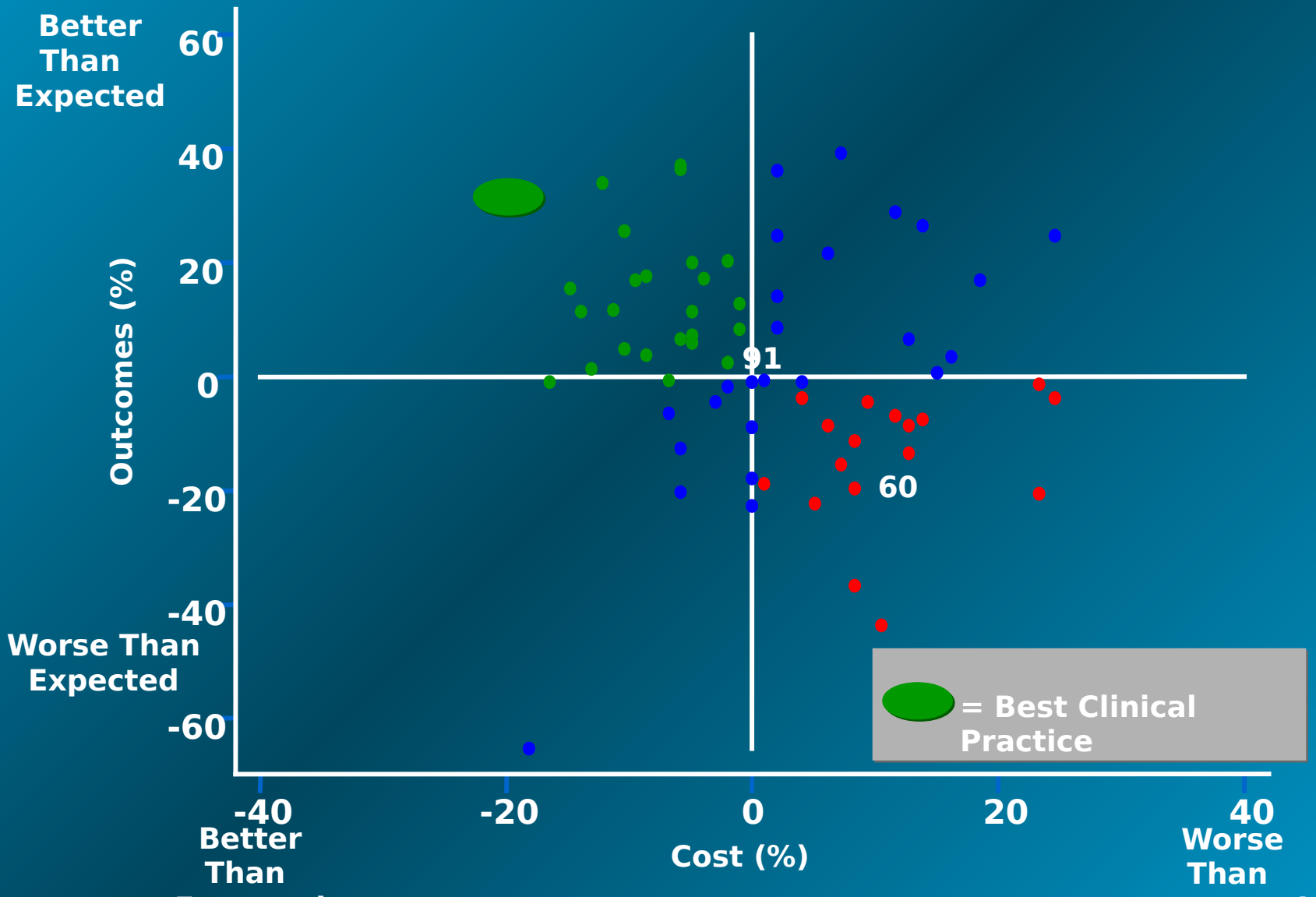
Actual to Expected Outcome Severity Scores by Hospital



Actual to Expected Resource Consumption in RCUs by Hospital



Pregnancy and Birth
Combined Maternal and Neonatal



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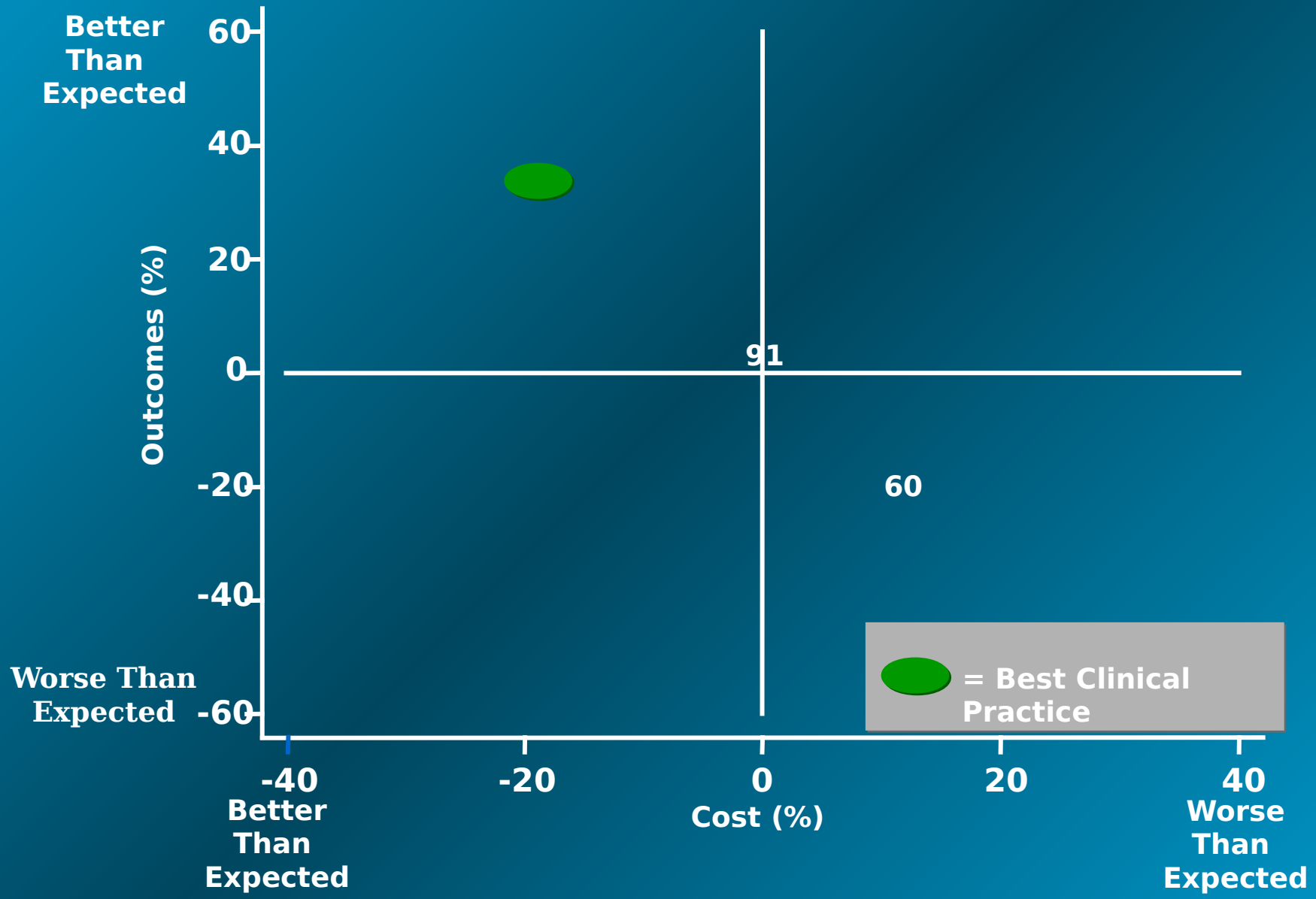
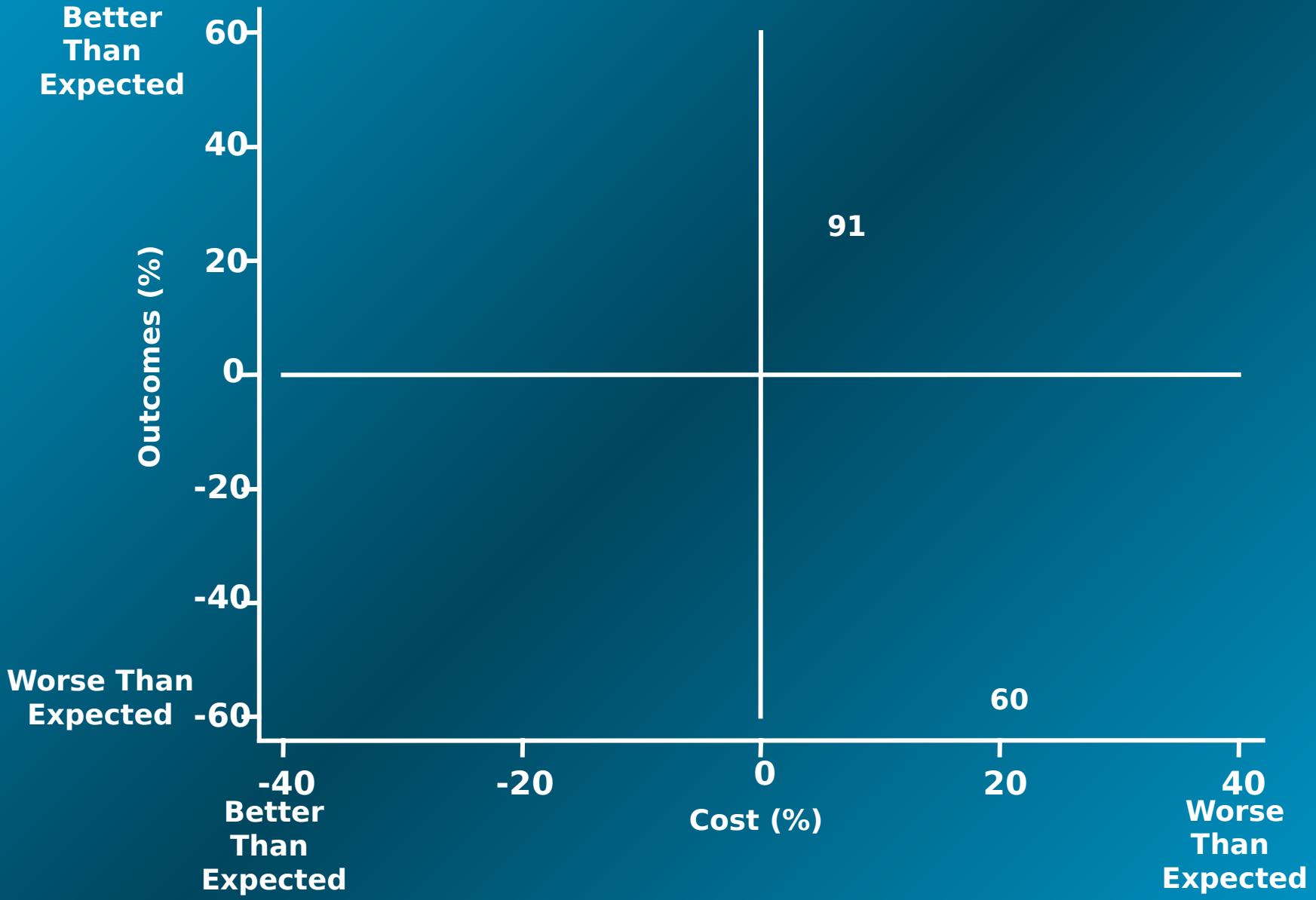


Pregnancy and Birth Neonatal



Intermediate Outcomes

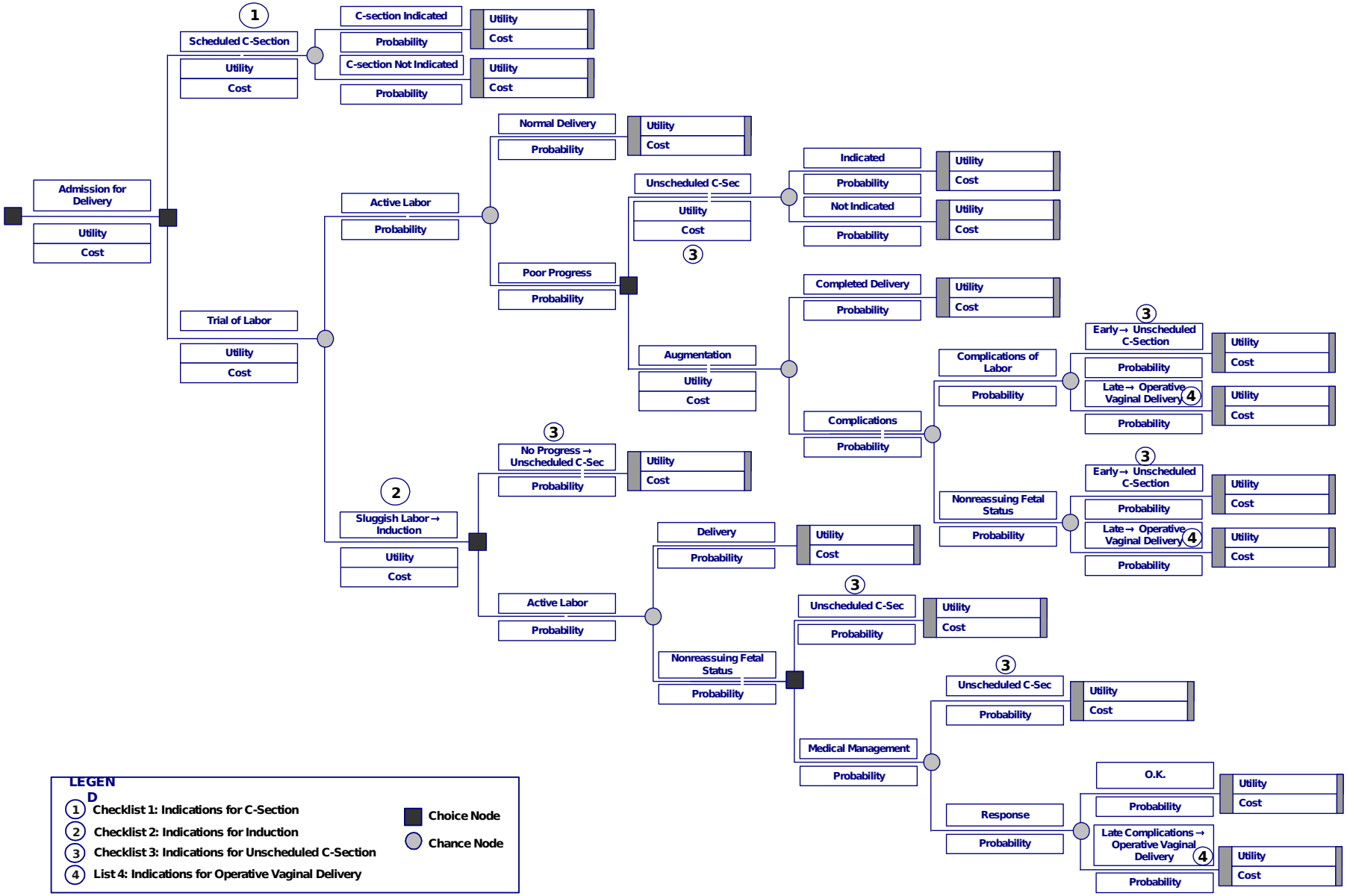
	Best Clinical Practice	National	Hospital 060	Hospital 091
MATERNAL				
Genital tract trauma	0.71 *	0.97	0.88	0.97
Infections	0.10	0.12	0.11	0.12
Uterine complications	0.13	0.12	0.15	0.09
Functional complications	0.05 *	0.12	0.16	0.06
Hemorrhagic complications	0.11	0.10	0.09	0.02 *
NEONATAL				
Neurological problems	0.00 *	0.05	0.06	0.06
Infections	0.02	0.06	0.13 *	0.05
Birth trauma	0.07	0.10	0.10	0.05
General conditions	0.34 *	0.49	0.54	0.71 *
Respiratory problems	0.19 *	0.38	0.54 *	0.43
Miscellaneous problems	0.19 *	0.44	0.41	0.14 *

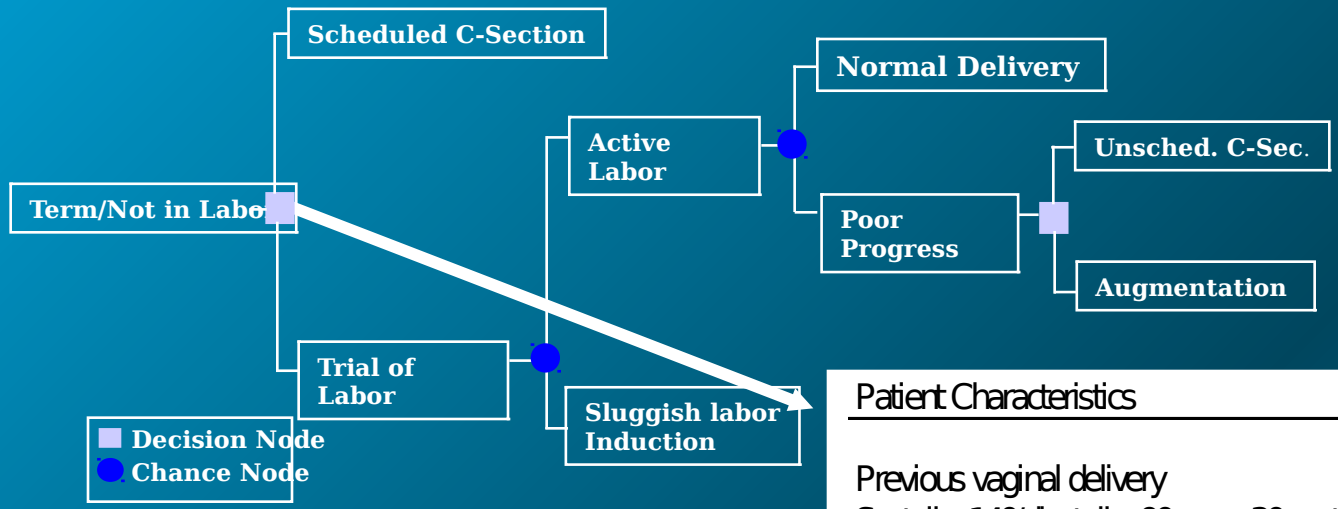
*Statistically significant difference from national average

Statistically Significant Processes of Care

Processes of Care	Change in Score	P value	Change in RCU	P value	Best Clinical Practice	National	Hospital 060	Hospital 091
Pre-admission Processes								
Amniocenteses done	0.54	0.00	0.10	0.00	4.4	4.4	2.60	1.90
Tocolytics administered	0.43	0.00	0.18	0.00	0.7	3.6	2.10	1.90
Non-stress test during admit	0.19	0.04	0.11	0.00	1.8	13.9	10.10	3.80
Epidural-continuous	0.20	0.01	0.06	0.00	12.2	25.8	55.00	17.30
Oxytocin/pitocin administered	0.30	0.00	0.11	0.00	33.1	41.5	56.60	35.60
Intrauterine pressure catheter	0.54	0.00	0.13	0.00	22.7	35.8	46.00	23.10
Amnioinfusion	0.79	0.00	0.14	0.00	2.9	8.9	17.50	3.80
MgSO4 administered	0.82	0.00	0.27	0.00	3.3	4.4	2.60	6.70
Tocolytic administered	1.17	0.00	0.23	0.00	0.7	3.6	2.10	1.90
Delivery Processes								
Vaginal delivery	-1.23	0.00	-0.24	0.00	78.1	72.5	71.40	80.80
Forceps delivery	1.26	0.00	0.08	0.00	3.2	5.5	0.50	1.90
Unscheduled C-section	1.53	0.00	0.38	0.00	8.4	11.9	16.90	3.80

Decision Support Algorithm





Checklist for Indications for Scheduled C-Section
Threshold Probability of Scheduled C-section = 0.42
Decision Threshold Score = 1.66

Patient Characteristics	Values	Checklist
Previous vaginal delivery	-1.54	
Systolic>140/diastolic>90, or >=30 systolic or >=15 diastolic rise, third to last visit	0.34	
Gestational diabetes	0.39	
Tobacco use before pregnancy, quantities unknown	0.37	
Premature rupture of membrane	0.51	
History of preeclampsia, mild/NOS	0.50	
History of chronic hypertension/HELLP	0.51	
Patient race- black	0.52	
Prenatal multiscreen abnormal	0.78	
History of preeclampsia, severe	0.82	
Antepartum/ultrasound finding, polyhydramnios	0.88	
Antepartum/ultrasound finding, high birth weigh	1.34	
Multiple gestation	1.40	
Previous C-section	1.77	
Malpresentation at 1st vaginal exam after admission	4.03	
Abnormal pelvis/contracted pelvis/cephalopelvic disproportion	4.69	
Herpes-overt/active lesion or prodomal symptom	5.25	
Decision Threshold Score =1.66	**TOTAL**	

Impact of Analysis

	Frequencies (% of deliveries)			
	MTF 060		MTF 091	
Processes	Current	Projected	Current	Projected
All C-section	20.11	20.63	11.54	10.58
Scheduled C-sections	3.17	15.87	7.69	8.65
Unscheduled C-sections	16.93	4.76	3.85	1.92
Vaginal Delivery	79.89	79.36	88.46	89.42
Forceps	0.53	0.53	1.92	1.92
Vacumn	5.82	5.82	3.85	3.85

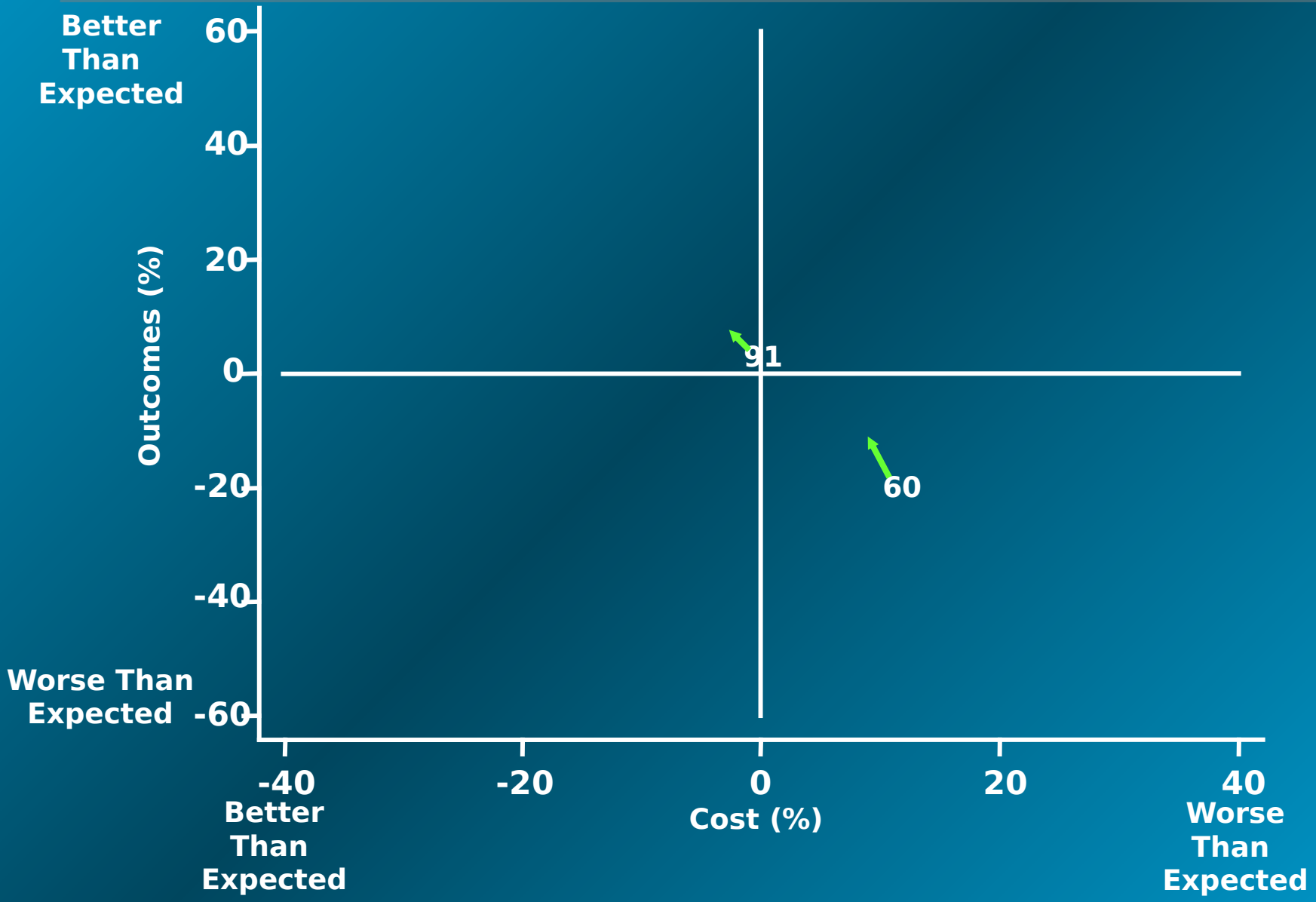
Impact of Analysis

	Hospital 060	Hospital 091
Improvement in outcome severity score per patient	-0.17	-0.09
Percentage improvement in outcome per patient	5.84%	3.09%
Percentage improvement in outcome per affected patient	21.75%	20.08%
Savings in resource use in terms of RCU per patient	6.53	5.29
Savings in resource use in $ per patient	$218.83	$177.29
Savings in resource use in $ per affected patient	$1,181.55	$1,675.49
Savings in resource use in % per patient	1.99%	1.79%
Savings in resource use in % per affected patient	8.84%	13.55%

Impact of Analysis

Pregnancy and Birth

Combined Maternal and Neonatal



Clinical Knowledge Management

- Theory of Clinical Knowledge Management
- Types of information healthcare executives need
- Information sources and safeguards for accuracy and confidentiality
- Analytic approaches to information
- Making change

Clinical Knowledge Management

Now that we have the right information, how can you use it to make changes in how we provide care…

Clinical Process Re-engineering

Three Principle Ways of Changing Processes

- **Substitute**
- **Automate**
- **Re-engineer**

Clinical Knowledge Management

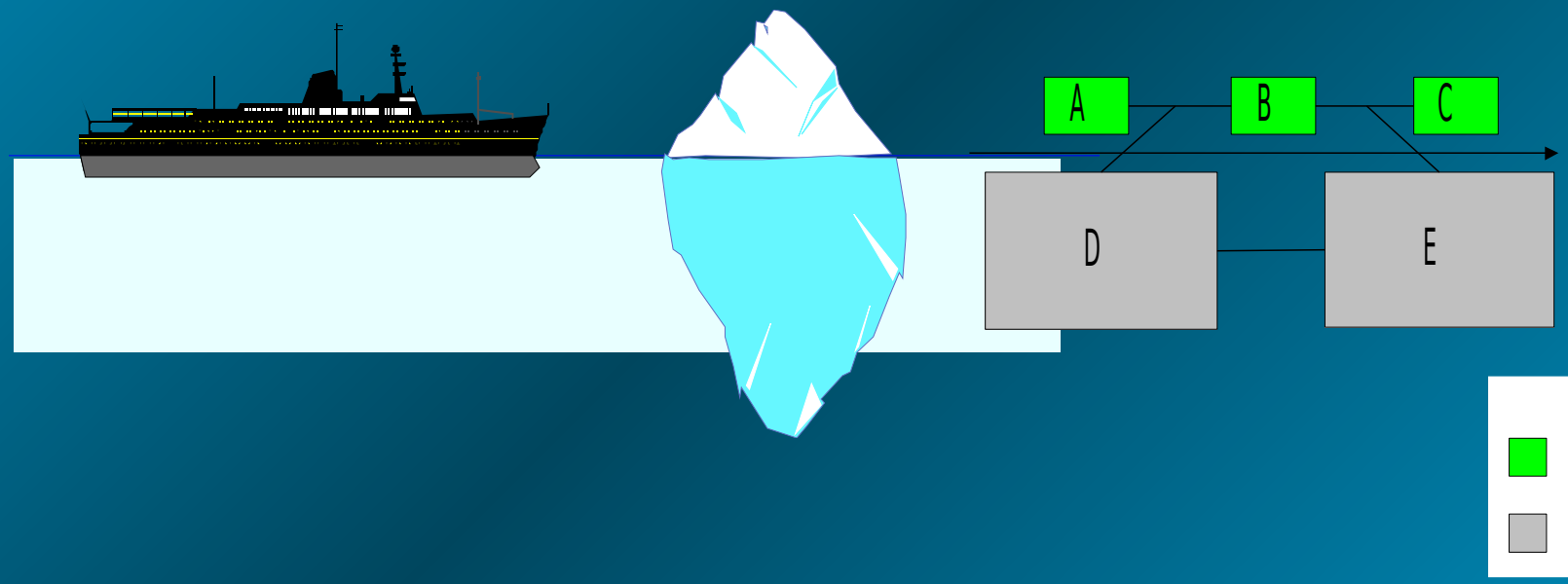
- Business process re-engineering
- Clinical Process Re-engineering

BPR Weaknesses

- Weakening of the patient service and patient focus
  - Apparently trivial roles may turn out to be the very roles that provide a meaningful relationship with the patient – telephone VRT
- Erosion of quality of work life
- Destruction of existing corporate culture
  - No cultural transformation
- Destruction of corporate memory
  - Fewer spread themselves thinner with less structure

Rob Mattison, Web Warehousing and Knowledge Management, p.64

Clinical Processes Often Go Unrecognized in BPR



Clinical Process Re-engineering
Re-defining Clinical Processes of Care

- Understanding of the processes of care
- Clinician use of data and information
  - Population health
  - Point of care
- Impact on Medical Decision Making

Key Requirements for Physician Acceptance of New Information Technology

- Improve the care they provide
  - Make better clinical decisions
- Increase their personal efficiency
- Make their work easier and faster

Clinical Knowledge Management

- Theory of Clinical Knowledge Management
- Types of information healthcare executives need
  - Depends on your goals
- Information sources and safeguards for accuracy and confidentiality
  - HIPAA
- Proper analytic approaches to information
- Making change

Clinical Knowledge Management

Questions?